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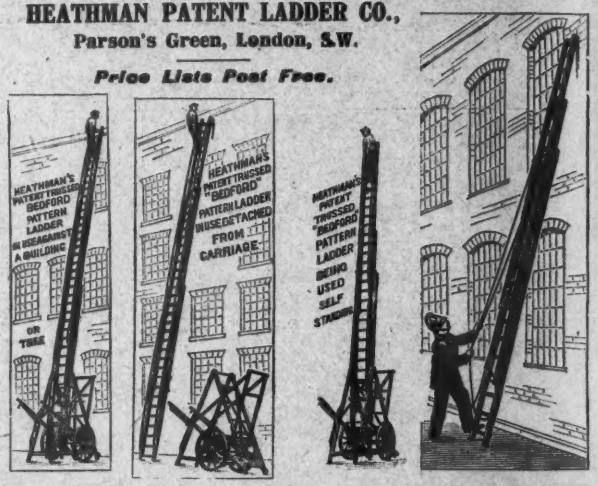
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THE AUSTRIAN ELECTRICAL INDUSTRY.

IT is now quite a year since we referred to the situation of the electrical industry in Austria, which even at that time was declared by a Vienna correspondent of the *E.T.Z.* to have overcome the initial difficulties which arose on the outbreak of the war. In the meantime, many events have taken place, and it may be of interest to inquire into the state of the industry as set forth in the columns of the leading newspaper in Vienna at the beginning of September. Although optimistic in tone, the report is free from the boasting strain which generally characterises the statements made in Germany in relation to Teutonic industries in particular. In the first place, the Vienna newspaper remarks that the state of the electrical manufacturing industry is very satisfactory, as there is no lack of activity owing to the great part played by electrical engineering in modern warfare, and the works are intensively occupied on the production of dynamos, motors, transformers, searchlight projectors, lamps, carbons, batteries, &c., together with cables and wire, and telephone and telegraph apparatus, for army and naval purposes. The question in this case concerns not only the meeting of the increase in the requirements, but also the renewal of worn-out and exhausted stocks. On the other hand, the demand on the part of private customers has receded largely to the background, but it has not come to a complete standstill, as many works and other establishments which are engaged on army contracts have been compelled to make extensions, and have had recourse to a greater extent to the use of electric power in consequence of the rapidity of execution of the work and the scarcity of labour. These developments have brought plenty of orders to the electrical works, although not yielding full compensation to the latter through the reserve manifested, except by some hydro-electric works engaged particularly on the production of artificial fertilisers, in the construction of new electricity works and tramways for the account of both municipal authorities and private companies. Yet even this deficiency has been equalised by more skilful adaptation and the assumption of new branches of manufacturing by embarking upon the production of munitions and allied war requirements.

It is under these circumstances, the report continues, that the difficulties have been surmounted and the results have been shown in the financial statements of the works. At the same time, it is admitted that a scarcity of skilled workmen has existed at times, owing to the calling of men to the army, and that raw materials became short and increasingly costly. But these obstacles are declared to have been overcome by the introduction of female labour and by technical ingenuity, which resulted in the provision of cheap substitutes for the raw materials in sufficient quantities.

The same conditions which influenced the manufacturing works are reported to have also applied to the electricity supply works, where there were a dearth of labour and a contraction in the deliveries of such materials as coal, lubricating oil, &c., and a display of reserve and economy in the use of artificial lighting, which was accentuated by the introduction of "summer-time" and the earlier closing of the shops. On the other hand, the supply of

electrical energy for power purposes has generally increased, so that the total consumption has not shown any considerable reduction. Apart from this development, both the manufacturing and the supply works are devoting themselves to the problems which have matured in consequence of the war. In the case of the former, for example, the idea of a syndicate has to some extent become a matter of special attraction, as such a combination would place a limit on irregularity in prices and conditions of sale, whilst at the same time it is thought that it would strengthen the idea of an economic connection with the German firms and groups, and so smooth the path towards the establishment of a common economic policy between the Central Powers in the electrical industry. This contention, in the opinion of its advocates, is supported by the argument that the intellectual and technical work as between Austria and Germany has always shown the most intimate points of contact, whereas the importance of the Customs duties from the standpoint of the expansion of the Austrian electrical industry has frequently been over-estimated, as was set forth statistically by E. Honigmann some time ago. In contradistinction to this view of the question, which is opposed by a number of firms, it is submitted that intellectual community is sufficient, owing to the apprehension that the powerful German industry would overthrow the Austrian trade.

A further factor in the situation relates to the supply branch of the industry, where the question of the institution of a Government electricity monopoly and the scheme for the imposition of a tax on consumption have been seriously brought forward.

The Industrial Worker and the War Funds.

The longer the war lasts the more important will become the financial burdens that, as a nation, we have to carry on our own behalf and on behalf of our Allies. The necessity for husbanding our resources, therefore, should command increasingly the serious attention of all of us who remain at home. Our brave Forces are doing magnificently in their particular spheres, and those who remain behind should be putting every ounce of their strength into efforts for keeping up the supply of munitions and conserving certain interests so that we may be able to carry out the Allies' fixed determination to dictate the terms of peace, and so that the Home Fires may be brightly burning for the boys when they come back to us. The horrors of war are being brought home to all to-day, but the poignancy of personal loss is being mitigated by the consoling knowledge that self-sacrifice is now the almost universal contribution to the winning of the Victory of the Freedom of Europe. But such contribution, magnificent as it is, and often so proudly and cheerfully borne, is by no means our only responsibility. Another and a very important one is represented by the War Savings movement. Many of our readers, no doubt, are professional men with fixed incomes who know only too well how the shoe pinches in these days of heavy taxes and increased expenses. They have been learning the lesson of doing without. Such, however, is by no means the case with millions of industrial workers, including hundreds of thousands of young women and lads who are handling weekly more money than they ever had before. Observers in certain factories state that the tendency towards extravagance spends itself after a few weeks, when the novelty of possession passes off, but in too many cases, unfortunately, this is not so, and money is expended freely upon what in war-time must be described as luxuries. What we have to do is to bring home to all industrial workers that they are rendering a distinct disservice to the nation if they purchase unnecessary things which tend either to occupy labour which ought to be free for national service in some other form, or which occupy transport and increase our import indebtedness to neutral countries. The nation needs the assistance of the millions in finding the money for the war as well as in actual fighting and munition-making. In addition to this, inasmuch as nobody can predict with certainty what the state of general employment will be after demobilisation, it is in the interests of the workers themselves that they should be putting their surplus earnings into a stocking in preparation for possible rainy days. Expert observers note with a certain measure of apprehension the industrial revolution which is taking place, and they urge upon us the necessity for doing without now in order that we may obviate serious deprivation then.

It may be imagined that, at first blush, this matter is of no concern to an electrical paper, but a careful study of the subject will, we are sure, show that it is a national matter, and is one which concerns all who are connected with our own industries. The establishment of War-Savings Committees in all parts of the kingdom is serving to bring the importance of the question home to the minds of the people, but we think that the various industrial businesses which we as a journal represent, employing hundreds of thousands of workers, may find it possible to assist the movement very materially. In the main, we believe that the spendthrift tendency could be checked by educating the people on points such as we have mentioned, and it is for those responsible for the management of our factories to devise means suited to their own particular cases for securing a patriotic response either by schemes of their own or by co-operation with the Government War-Savings Committees. There may still remain some workers, particularly among the junior classes of both sexes, whose appreciation of the responsibilities of life is so light that they will prefer to "eat, drink, and be merry" unless by some form of peaceful suasion they can be induced, in their own and in the Allied interest, to take all above a certain necessary proportion of their earnings in the form of War-Savings Certificates. The very last thing that we should care to advocate would be excessive infringement of personal liberties in days when we are fighting the oppression of Prussian militarism, but in times when we have conscription of man-power we sometimes hear the cry also for the "conscription of wealth." To ask the "wealthier" wage-earners to lend their surplus wages to the State at a high rate of interest falls a long way short of conscription, and, to our mind, it would be quite as justifiable a proceeding as to ask the investor to hand over American securities for the financial convenience of the nation. Perhaps it might be as well for directors and managers of our companies and businesses to consider what further steps they can legitimately take financially to assist the Allied cause without occasioning untimely friction among their workpeople.

Workmen's Compensation.

The case of Woolley *v.* Watson, Marsh & Co., Ltd., which was reported in our issue of October 13th, at p. 410, appears to deserve some further notice. The applicant claimed compensation for injury occasioned by an accident arising out of and in the course of his employment. He was a skilled electrician working at a kinema palace which was being reconstructed. It was alleged by the respondents, on the testimony of two witnesses, that at the time of the accident the applicant was assisting a labourer employed by another firm also working on the job. The applicant denied this story, and his denial was accepted by the learned judge on the ground that "the respondents could have called the man in support of their story." In

our necessarily brief epitome of the case as it was presented to the learned judge, we were unable to set out all the facts. In so far as he decided a question of fact in favour of the applicant we should not venture to criticise his decision, but, according to a letter which we have since received from the respondents, the judge is said to have ruled that "where there are numerous contractors working on a job together, and one firm's man goes to the assistance of another man who is not under the same employer, and an accident occurs by so doing, although that man is not actually in the course of his employment, his employer is responsible."

If this is an accurate version of what the judge said, it is open to two objections. In the first place, it appears to be directly contrary to numerous decisions of the Court of Appeal, and, in the second place, it was a mere *obiter dictum*, that is to say, an expression of opinion which was unnecessary for the decision of the case, because it was open to the judge to find as a fact that the story about the barrow was untrue. That some such point was discussed is clear from what the judge (according to our report) said in his judgment: "He deprecated all these quibbling points that were so often raised in cases of this kind." We venture to deprecate any such general expression of opinion as calculated to bring the administration of County Court justice into disrepute. Whether he be a workman or an employer backed by an insurance company, every litigant is entitled to bring his case before the Court and have it decided according to law. If a legal point appears to be a quibble, that is the fault of the legislator who made the law, not the fault of the lawyer who raises the point in the interests of his client. If County Court judges go out of their way to make observations of this kind they have only themselves to blame if an impression gets abroad in some districts that when there is a dispute between workman and employer the scales are weighted in favour of the workman.

The Prevention of Bribery.

We have received from the Bribery and Secret Commissions Prevention League an interesting communication summarising the work achieved during the war in the direction of stamping out this detestable practice, with which of late the public has become only too familiar. They point out that, in order to obtain the necessary evidence to convict, in almost every case, one side has to be allowed to go free, and to give evidence against the other; in fact, to be bribed to do so with a free pardon.

Until recently, it appears, the view has been taken by the judicial authorities that it is the man who betrays his fiduciary position who must be punished in those cases in which the conviction of only one of the parties is possible. Only in a single case has a contractor been convicted for attempted bribery.

For years we have endeavoured to distinguish clearly between bribery and blackmail; and we are still of opinion that blackmailing is the commoner offence of the two. No man offers a bribe to another, unless he is convinced that bribery affords the only method of doing business in that particular quarter; in other words, that the purchaser's agent is a blackmailer who must be "squared" either to give the order, or afterwards to pass the goods.

Mr. Asquith stated in the House of Commons the other day that the Home Secretary would introduce a Bill at an early date to deal with contractors who bribed or attempted to bribe public servants. The League is also at present promoting an amending Bill in Parliament, which has for its object the removal of the Attorney-General's fiat, which is now necessary before a prosecution can be undertaken.

We are by no means in agreement with this proposal, as we think it would open the door to false accusation and persecutions of a particularly obnoxious character. All the same, we would support any amendment of the Bill which would make it more effective against the evil, which, we fear, is a great and growing one.

Our faith in legislation, however, is limited; and we venture to suggest to the League that much more propaganda work might be undertaken with advantage. For instance, a lecture describing exactly the nature of the offence (on which many people are extremely vague in their ideas) ought to be carefully prepared and issued to all schools and colleges to be read out by the headmaster to the assembled school at stated intervals.

If the tradesmen who have the privilege of supplying school books, stationery, and other articles to the pupils could attend at the reading it might also be useful.

A short declaration describing the offence in clear terms should be submitted to and signed by every official of the Government or of the municipalities before appointment, and a similar printed declaration might with advantage be adopted in private firms.

A definite question should be introduced in all Civil Service examinations, and also in those of the great engineering societies. Law examinations should also not omit such an important subject; as we fear even solicitors occasionally take a little consideration from insurance societies and mortgage brokers to whom they recommend their clients, or a "negotiation fee" when arranging a loan. The same men generally carry their righteous indignation to excess when some wretched traveller, acting under secret instructions from his principals, gets caught offering to share his own commission with a buyer, when the living of himself and his family may depend on getting the order. Finally, and most important of all, as urged by Lord Cromer, reasonably adequate salaries should be attached to responsible positions.

A Department of Commercial Intelligence.

The announcement that the President of the Board of Trade has decided to amalgamate the Commercial Intelligence Branch and the Exhibitions Branch of the Board and to call the combined department the Department of Commercial Intelligence will be welcomed by traders generally. The two branches have both performed excellent service to the trading community, and their activities have been particularly marked while we have been at war. In normal times their operations have, of course, been handicapped by certain limitations, and a good deal of criticism has been offered, not always, we fear, because of their want of merit, but sometimes because it has been the habit to judge them as the offspring of the Board of Trade. We have frequently stated here that our own experience of the Commercial Intelligence Branch has not been by any means unsatisfactory. Our relations with those responsible for its conduct have always been of the most cordial kind. They have placed themselves at our disposal time and time again with all the willingness and courtesy that anyone could desire, and they have never found us lacking when opportunities have arisen for us to co-operate with them in matters calling for any information that it lay in our power to give. We are particularly anxious to pay this tribute to the Department on the occasion of the retirement of Mr. Thomas Worthington, who has had its doings under his supervision as director right from its initiation, and has now retired under the age limit. Exactly what the amalgamation of the two departments will mean in regard to detailed working experience will show, but Sir William Clark, K.C.S.I., C.M.G., who will

be Controller-General of the new department, is a young man with a wide experience of both diplomatic and industrial affairs, and he takes the helm at a time when it is intended "to improve the organisation for assisting British trade by collecting and disseminating commercial information."

The change is a sign of Government movement in the interests of national trade, and we must be thankful if only for that, but it comes at perhaps the most important parting of the ways that has ever occurred in connection with British trade, and if Sir William is able to sort out from the floods of trade suggestions that have overwhelmed us all during the past two years a few of the best, and apply them, our industries will reap great benefit during the period of his office. We offer him and his department our hearty good wishes in the large and difficult undertaking upon which they now set out. No doubt many questions will arise for revision under his guidance as he meets the Commercial Intelligence Committee from time to time, and among these there will inevitably be the matter of publicity. It may be necessary to consider whether the present manner of handling trade and consular reports, the form of the Board of Trade *Journal*, and even the constitution of the Committee of the Department, are all that the needs of to-day call for, and it may be that it will be found possible to secure more active co-operation from the trade Press, now too often prone to scoff; but in regard to these things we must at present wait and see.

Industrial Fatigue.

The second interim report of Dr. A. F. Stanley Kent on industrial fatigue, which we summarise elsewhere in this issue, is a valuable addition to our knowledge of a subject which has been far too long neglected, and affords an interesting example of the application of scientific method to industrial conditions. In other words, it illustrates the importance of *measurement and system* as opposed to guesswork and superficial reasoning, for the author establishes by experiment the fact that the output of the human organism, unlike that of a machine, is not proportional to the hours of labour, but may even show a material increase when the working period is shortened. Hence he concludes that the working of overtime, and particularly Sunday labour, is generally detrimental to output, as well as to the health and well-being of the worker, and is both physiologically and economically extravagant. It is not clear, however, that these conclusions apply without modification to workers who may be classed as "machine-minders," and whose output is not dependent upon their manual dexterity and physical effort, though the quality of the work in this case may suffer from the relaxation of their attention or the lessened acuity of their senses.

The process of recovery from fatigue is not confined to periods of rest, but is constantly in progress even whilst fatigue is being produced, and the author points out the difficulty of isolating these antagonistic effects; he remarks that only the resultant is of importance, but it would seem that if more detailed knowledge could be obtained regarding each of these factors the information would be very helpful in organising the programme of work. It has been shown by previous investigators that by a proper allocation of the working time to successive periods of work and rest, extraordinary results can be obtained, and if we only knew the laws which govern the physiological processes it might be possible greatly to increase output without imposing any additional strain on the worker. It is evident also from the observation of Dr. Kent and his assistants that greater attention should be paid to the feeding of the factory worker, by the dissemination of sound ideas as to diet as well as the provision of well-managed canteens at the factories, the cost of which would be abundantly repaid.

THE USE OF IONISED AIR IN AGRICULTURE.*

By INGVAR JORGENSEN.

During the last 10 to 15 years some interest has been aroused both in agricultural and technical circles in regard to the application of ionised air (produced by an electric discharge from a system of thin wires) in agriculture and other plant industries.

It is impossible to deal with the history of the subject briefly, as it is one of the oldest branches of electrical science, and the literature is very voluminous. It will be sufficient to state that interest in the subject in this country mainly dates from the publication of Prof. Lemström's book in 1904.† Subsequently Mr. J. E. Newman started some experiments, and developed, in conjunction with Sir O. Lodge, a new method for generating the necessary high-tension electricity, and a new arrangement of the overhead network; this apparatus is sold by the Agricultural Electric Discharge Co., of Gloucester. It has been described so frequently in recent years in various technical and agricultural journals, that it is unnecessary to enter into a detailed description here. Sir O. Lodge gave a fairly complete account of the experiments undertaken by the Agricultural Electric Discharge Co. in his Kelvin lecture to the Institution of Electrical Engineers in 1914.‡ The technical information given was, however, very meagre, and on many points not very helpful; I have therefore attempted in the present paper to state some of the fundamental principles involved in the method, in the hope that electrical engineers may be persuaded to take some interest in the matter, for the resulting technical research should lead to the replacement of the present system by a cheaper and more efficient one.

The methods employed by both Prof. Lemström and Sir O. Lodge were very primitive, and it is to be regretted that these two eminent physicists have not attempted to investigate the physical questions involved in the scientific application of the method. The entire absence of quantitative measurements is a striking feature of their work, although it is clear that, without such measurements, satisfactory progress is not possible.

If the subject is to be advanced from the position in which it has remained now for 200 years—that of an amusing pastime for electrical amateurs—an extensive series of researches is required, and close collaboration between electrical engineers and agricultural scientists becomes necessary. The results of the investigation which has been carried out for the Board of Agriculture in the last four years seem to indicate that such a research might be profitable.

The chief features of the Newman-Lodge system are as follows:—

Alternating high-tension current is generated by an induction coil (mercury turbine break, condenser in parallel with the primary). One terminal of the secondary is connected to earth; the other is connected through a series of Lodge rectifiers‖ to the discharge network. The construction of this network will be seen from fig. 3. The wire system is carried on insulators of the type used in high-tension power transmission, which are mounted on poles. The wires nowhere touch the insulators, but are held taut at some distance from them by means of paraffined cord. The distance of the network above the ground is 15 ft.

The apparatus provided by the Agricultural Discharge Co. is generally supplied with an ammeter in the primary circuit and spark gaps (1-in. balls) before and after the rectifiers. If the apparatus is started, the ammeter will

* The information contained in this article is derived from experiments carried out by the writer in Copenhagen (at the Government Agricultural Experimental Station) and in this country under the Board of Agriculture, in conjunction, first, with Prof. J. H. Priestley (University of Leeds), and, later, with Prof. V. H. Blackman (Imperial College of Science and Technology).

† S. Lemström, "Electricity in Agriculture and Horticulture," 1904.

‡ O. Lodge, *Journal* Inst. Elect. Eng., March 2nd, 1914.

‖ A description of this valve will be found in *Phil. Mag.*, 1911, Vol. XXII, page 1.

probably show that 2—3 amperes are used in the primary of the coil, and the sparking distance at the field spark gap (indicating the potential difference between the wire network and earth) to be ½ in.—¾ in. These are the facts available from Sir O. Lodge's experiments; what further happens he describes in a manner which is not very helpful scientifically.

"Leakage immediately begins, and the charge fizzes off from the wires with a sound which is sometimes audible, and with a glow sometimes visible in the dark. Anyone walking about below the wires can sometimes feel the effect on the hair of the head as of a cobweb on the face. They are then feeling the stimulating action of the electrification."

This reminds one strikingly of another worker on the subject of electro-culture, Garolla (1892), who sent a current from galvanic cells through the soil of some pot cultures, and used a current of such a strength "that it burns the tongue."

However, some information may be obtained from measurements in the high-tension circuit. To illustrate this, I may refer to some experiments of my own,* where a wire (galvanised iron) was suspended 1 metre from the ground. The length of the wire was 10 metres. It was charged

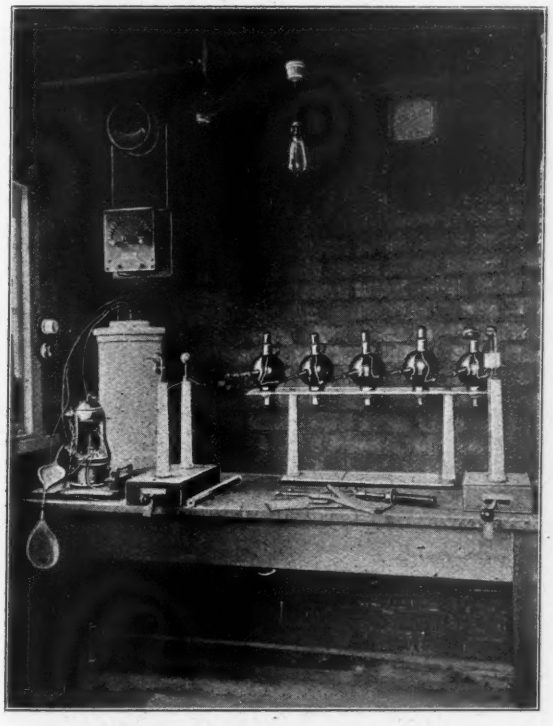


Fig. 1.—Showing the Lodge-Newman Apparatus.

From left to right: Mercury turbine break with gas-bag for coal gas, induction coil, spark gap, five Lodge valves, and field spark gap. From here the wave is carried to the field through the window at the top of the picture; insulated cable such as is used in X-ray work is employed between the spark gap and the first pole (surrounded by a piece of quartz tubing where the cable passes through the window).

from an influence machine revolving at a constant speed. By using wires of different diameter it will be observed that both the current passing through the discharge wire and the potential to which it can be charged vary considerably:—

Diameter of wire.	Voltage.	Current.
0·36 mm.	27,000	$2·6 \times 10^{-5}$ amperes
0·45 „	30,000	$2·0 \times 10^{-5}$ „
0·85 „	30,000	$1·5 \times 10^{-5}$ „
2·15 „	36,000	$0·75 \times 10^{-5}$ „

Similar big variations are obtained by keeping the diameter of the wire constant and varying its distance from the ground. The nearer the wire is to the ground, the bigger is the current and the lower the voltage to which the wire can be kept charged. Also it is noticed that the current is bigger when the wire is charged negatively (up to 1·5 times as much as when it is charged positively).

All these facts are, of course, only confirmation of what would be expected from pure physical principles (see, for instance, J. J. Thomson: "Conduction of Electricity through Gases").

A cotton-covered wire will give a stronger discharge than a bare wire of the same diameter if the atmosphere is dry.

Such measurements in the high-tension circuit (or earth circuit) are necessarily very approximate, and when high voltages are used, as in the Lodge-Newman apparatus, they require rather special apparatus for measurement.

The following facts are disclosed by such crude measurements:—

For a definite source of high-tension electricity the strength of the discharge depends on:—

1. The sign of the charge.
2. The diameter of the discharge wire.
3. The distance from ground of the discharge wire.

To this may be added if more complicated systems of discharge wires are used:—

4. The physical structure of the elements (wires, &c.) of the discharging system.
5. The number of discharge wires employed, and the distance between them.

A comparison between the system used by Lemström and that of Lodge-Newman will make clear how impossible it is

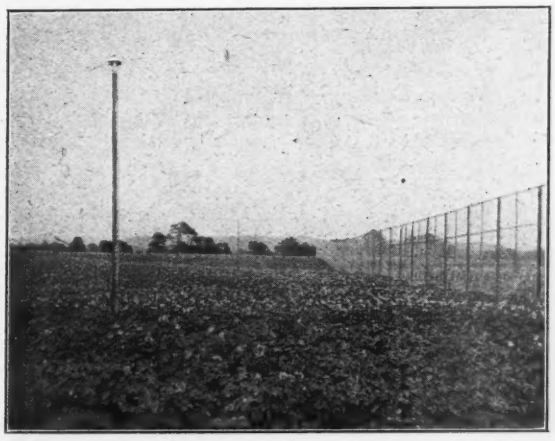


Fig. 2.—Showing a Pole with Insulator.

Distance, 15 ft. from ground. To the right a screen of ½-in. wire netting, which was used in some preliminary experiments to prevent the discharge from reaching the "control." This screen did not prove any good, as it was considerably lower than the discharge wires.

to judge the relative merits of the two systems when technical measurements are not at hand:—

—	Diameter of discharge wire.	Distance from ground.	Distance between discharge wires.	Spark length between net and earth.	Sign of charge.
Lemström ...	0·6 mm., but with discharge points every metre.	0·4 m.	1·25 m.	0·5—2·5 mm.	+ or −
Lodge-Newman	0·6 mm.	5 m.	10 m.	10—20 mm.	+

It will also be understood that the measurement of spark length is not very helpful in attempting to get an absolute measure of the discharge.

Still more complicated than the laboratory conditions are the conditions under which the discharge takes place in the open air. Meteorological factors obviously play a much more important part, and cannot be controlled as in laboratory experiments. It becomes imperative to obtain an absolute measure of the current actually passing through the air. The writer has made an attempt to develop certain methods of measurement of the electric air currents. These measurements were not undertaken from the point of view

* I. Jorgensen, Tidsskrift for Vindelektricitet, Copenhagen, May, 1910.

of physical research, but in order to obtain quick and easy methods which could be conveniently employed in the agricultural experiments.

Let us consider the physical processes concerned in the discharge. What happens is that neutral gas molecules acquire a charge, + or − . According to the working theory of modern physics, the structure of the atom can be represented by assuming the presence of one or more positively charged nuclei, round which revolve negatively charged electrons. Thus the hydrogen atom, which is the simplest built atom, consists of one nucleus and one electron. The charge of the nucleus and the electron is the same with opposite sign (5×10^{-10} electrostatic units).

If an electron is removed from an atom or molecule, the latter will assume a positive charge; if an electron is added to a system it will appear with a positive charge.

In the case of a discharge of electricity from a thin wire charged to a high potential—positively, for example—it can be imagined that the charging of the wire consists in the withdrawal of electrons from the metal molecules, these electrons being replaced by electrons from the gas molecules in the neighbourhood of the wires. The charged atoms or molecules (ions) will move towards earth under the influence of the electric forces (potential difference between the charged wire and ground); from neutral molecules in the plant or soil they will acquire electrons, and thus become neutral, &c.

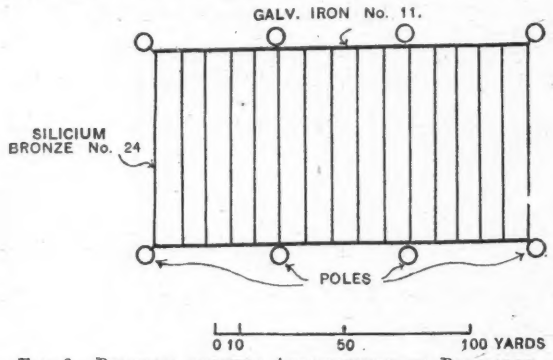


Fig. 3.—Diagram showing Arrangement of Discharge Network.

In the discharge in atmospheric air the ions will not be simply atoms or molecules, but a charged atom or molecule surrounded by a cluster of neutral molecules. The number of molecules determines the speed with which the ions travel under the influence of an electric field, *e.g.*, the ion is characterised by its mobility, the velocity of an ion in a field of an intensity of 1 volt per cm.

A general expression for the current passing through the air is the following :—

$$i = n u e,$$

where i is current density, n the number of ions, u the velocity of the positive ions, and e the charge of an ion (5×10^{-10} electrostatic units); if both positive and negative ions were formed the expression would have been—

$$i = n_1 u_1 e + n_2 u_2 e;$$

but measurements showed that with the wires charged positively the current was carried only by positive ions.

The formula may also be written $i = n \cdot e \cdot dv/dx \cdot c$ where the velocity of the ions has been replaced by the product of potential gradient dv/dx and the specific velocity of the ions. The product $n e c$ is called the specific conductivity of the air.

On the determination of these two quantities, the potential gradient and the specific conductivity, depends the measurement of such small electric currents in the air as are produced by the Lodge-Newman system.

Space does not permit of a lengthy description of the apparatus employed for the measurements and the precautions which must be taken in order to obtain reliable results; the reader is referred to a text-book on atmospheric electricity — Mache and Schweidler,* for instance—where measurements of a somewhat similar nature are described.

(To be concluded.)

* Mache und Schweidler : "Die Atmosphärische Elektrizität." Braunschweig, 1909.

THE PRODUCTION OF SMALL DRY BATTERIES IN THE U.S.A.

In a paper recently read before the American Electrochemical Society, C. F. Burgess called attention to the remarkable growth in the production of dry cells, despite developments in the telephone field, signal work, and gas-engine ignition, which have been predicted as factors to reduce greatly the demand for dry cells. The author stated that if 50,000,000 represents the annual output of standard, or so-called No. 6, dry cells in the United States, this figure may be multiplied several times to represent the number of small dry cells used for flashlight and miscellaneous other purposes. High-efficiency miniature tungsten lamps and improved quality of the battery have been important factors in stimulating the flashlight industry.

Considerable information was given in the paper on efficiency, output, and other characteristics of small dry cells, based on a summary of tests made on about 4,000 cells. The two most important characteristics by which the value of a flashlight battery may be determined, according to the author of the paper, are ability to furnish light over a period of time, or its capacity, and its ability to withstand deterioration when not in use, or its shelf life. Other characteristics of importance are voltage, recuperation, uniformity, size, and cost. An accompanying table gives data on flashlight lamps as now standardised by manufacturers.

TABLE I.—Rating of Dry Cells for Flashlights.

Flashlight bulbs.	Volts.	Amperes.	Type of battery to be used.	Ohms resistance per cell.
Clear ...	2·7	0·35	2-cell—tubular type	3·84
	3·8	0·35	3 cell—tubular type	3·62
	2·9	0·35	2 cell—tubular type	4·14
	4·0	0·35	3 cell—tubular type	3·81
Opal back...	2·5	0·35	2 cell—case type	3·57
	3·8	0·35	3 cell—case type	3·62
	2·5	0·25	2 cell—case type	5·00
			Average... ...	3·94

The data in the table indicate that about 4 ohms is the average resistance of the common sizes of lamps, and this is adopted as the standard. It is the resistance recommended by the committee on standard methods of testing dry cells, as outlined in the transactions of the American Electrochemical Society. A voltage of 0·5 across the cell terminals when delivering current to the 4 ohms resistance is taken as the point where the current has fallen so low as to give a non-useful light. The standard method of capacity test consists in connecting an individual cell to a resistance coil of 4 ohms, and discharging continuously until its voltage drops to 0·5 volt. Most of the flashlight cells will drop to 0·5 volt during an eight-hour period. The larger cells will run beyond this, giving some chance to recuperate before the beginning of the following test period.

TABLE II.—Capacity or Hours of Burning for Small Dry Cells.

Brand.	Size of cells—inches. $2\frac{1}{4} \times 1\frac{1}{4}$	$1\frac{13}{16} \times \frac{15}{16}$	$2\frac{1}{8} \times \frac{3}{4}$	$1\frac{5}{8} \times \frac{5}{8}$	$1\frac{9}{16} \times \frac{9}{16}$	$1\frac{7}{8} \times \frac{9}{16}$
A	13·25	3·5	3·75	1·9	56 min.	70 min.
B	—	3·6	4·2	1·7	—	—
C	10·5	2	—	·85	13 min.	—
D	13·25	5	4·2	2·0	63 min.	66 min
E	13·75	4·1	—	1·4	40 min.	—
F	9·25	3·1	2·5	1·25	34 min.	45 min.
G	8·75	3·2	2	1·1	—	—
H	13·25	4·3	4	1·9	40 min.	75 min.

TABLE III.—Durability or Shelf Wear for Small Dry Cells.

Expressed in monthly percentage reduction in flash.

Brand.	Size of cells—inches. $2\frac{1}{4} \times 1\frac{1}{4}$	$1\frac{13}{16} \times \frac{15}{16}$	$2\frac{1}{8} \times \frac{3}{4}$	$1\frac{5}{8} \times \frac{5}{8}$	$1\frac{9}{16} \times \frac{9}{16}$	$1\frac{7}{8} \times \frac{9}{16}$
A	3·66	8·3	9·2	9	12	9·3
B	1·55	6·45	9·1	10	—	—
C	1·87	3·83	—	5	25	—
D	2·40	5·7	5·0	8·1	6·6	10·5
E	5·10	7·5	—	9·6	14	15·3
F	14·3	11·2	14·1	25·0	—	14·0
G	10·8	12	10	22·0	25	—
H	10	12·5	9·1	15·0	27	13·3

The author states that, from long experience and a great many tests, the best method of determining the deterioration going on within the cell is by measuring the short-circuit flash which the cell gives when connected momentarily to an ammeter. A cell which gives a flash current of 8 amperes when new may drop

to 4 amperes after six months, and this indicates roughly a depreciation in capacity of 50 per cent. While the decrease in flash is not strictly proportional to the decrease in ampere-hour capacity, it is nevertheless a far better indication than is the drop in open-circuit voltage.

Dry cells vary in initial voltage far less than they do in other characteristics. The author pointed out that grades of materials supplied as well as the methods of manufacture influence the voltage to a small degree. Likewise the ability of a battery to "recuperate" can be given to a cell by certain variations in the methods of manufacture. Thus a coarser grade of manganese will show a higher recuperative ability than will a very finely powdered more active grade. In general, it may be considered that high recuperative ability is inconsistent with ability to deliver current constantly without serious dropping in voltage.

TABLE IV.—Performance that Should be Expected from a Dry Cell of Good Quality.

Cell dimensions.	Capacity, minutes.	Per cent. monthly deterioration.
2·25 × 1·25 in. (57·2 × 38·8 mm.) ...	960	Under 4
1·8125 × 0·9375 in. (46·1 × 23·8 mm.)	300	Under 6
2·125 × 0·75 in. (54 × 19·1 mm.) ...	250	Under 8
1·875 × 0·625 in. (47·7 × 15·9 mm.)	120	Under 10
1·5625 × 0·5625 in. (39·7 × 14·3 mm.)	65	Under 12
1·875 × 0·5625 in. (47·7 × 14·3 mm.)	70	Under 12

The data in Tables II and III give results of tests on different brands of dry cells purchased in the open market. The capacity tests show that the best cells have a capacity of about 100 per cent. above the poorest, and from the durability tests the differences are much greater. The performance that should be expected of good quality dry cells is shown in Table IV.—*Electrical World.*

THE NATIONAL INSURANCE ACT, 1911.

Unemployment Insurance.—Further Decisions of the Umpire.

The following additional decisions have been published:—

Contributions are Payable for

1,946 X. Warehousemen, storekeepers, caretakers, timekeepers or watchmen employed wholly or mainly by way of manual labour in factories or workshops, or in yards or stores immediately connected therewith, when the aforesaid factories or workshops are engaged wholly or mainly in munitions work, or in any of the trades insured under the National Insurance (Part II) (Munition Workers) Act, 1916.

1,947 X. Porters, packers, messengers, cleaners, or weighmen employed in factories or workshops, or in yards or stores immediately connected therewith, when the aforesaid factories or workshops are engaged wholly or mainly in munitions work, or in any of the trades insured under the National Insurance (Part II) (Munition Workers) Act, 1916.

1,948 X. Engine drivers, boilermen, firemen, stokers, cleaners, oilers and other workmen engaged wholly or mainly in tenting, driving or minding engines or machinery, or in stoking boilers for the production of power, light, or heat for use in connection with munitions work or in any of the trades insured under the National Insurance (Part II) (Munition Workers) Act, 1916.

(This decision does not relate to workmen employed by separate companies or authorities who sell electricity or power for general purposes.)

1,960 X. Workmen engaged in assembling cycle and motor repair outfits intended for use in war.

1,963 X. Workmen engaged wholly or mainly in vitreous enamelling upon metal.

1,964 X. Workmen engaged in repairing machinery belting in an establishment which is engaged wholly or mainly in munitions work or in any trade which is insurable under the National Insurance (Part II) (Munition Workers) Act, 1916.

1,965 X. Workmen engaged in making metal patterns as described in Decision B 1,138 (*Board of Trade Journal* of October 24th, 1912) or in making patterns of other materials, if the patterns are for use in the manufacture of metal goods.

Note.—Decision B 1,138 reads as follows:—

Workmen engaged in making metal patterns (other than cast-iron patterns) not being for the use of iron, steel, brass or other foundries which are engaged wholly or mainly in making castings for use as parts of the products of a mechanical engineering establishment.

Contributions are NOT Payable for

1,954. Workmen engaged wholly or mainly in the manufacture of porcelain insulators or of porcelain parts of electrical switches, lampholders or other fittings, unless such insulators or switches, &c., are intended for use in war.

1,961. Colliery electricians engaged wholly or mainly in the maintenance of electric light and power installations in or about the colliery (but not in colliery buildings or shops) and not engaged wholly or mainly in repairs to the electrical machinery or switchgear.

1,962. Workmen described as out-door erectors and engaged wholly or mainly in the installation of accumulators.

1,967. Workmen employed in crushing blast furnace slag for use as material for road-making.

Notice is given that the Umpire has received an application for a decision as to whether contributions are payable or not in respect of stablemen employed in connection with any insured trade (476 X).

Any representations were to be made in writing to the Umpire by, or on behalf of, any workman or employer, and forwarded to the Registrar, Office of the Umpire, 47, Victoria Street, London, S.W., on or before October 26th, 1916. A decision on this application will be given on or after October 30th.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

G.E.C. Rotary Converter Traction Equipment in Barcelona.

The accompanying views show the electrical equipment of the Coello sub-station of the Barcelona Tramways Co., aggregating 1,500 kw. Three-phase power is received at 6,000 volts, reduced to 450 volts by oil-insulated air-cooled transformers in the basement and is situated between the machines. To gain access to each transformer, a removable checquer plate is let into the floor, which can be lifted when the transformer needs attention or inspection. The converting equipment comprises three 500-kw. shunt-wound Witton rotary converters running at a speed of 750 r.p.m., fitted with interpoles, and generating direct current at 600 volts. The energy so produced is used entirely for traction purposes.

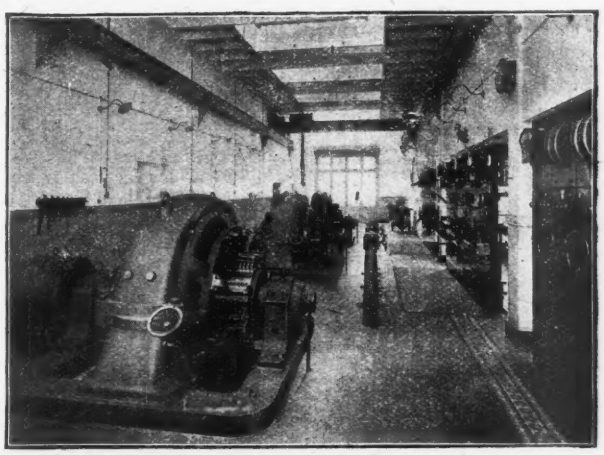


Fig. 1.—The Coello Sub-station of the Barcelona Tramways Co., showing "Witton" Rotary Converters.

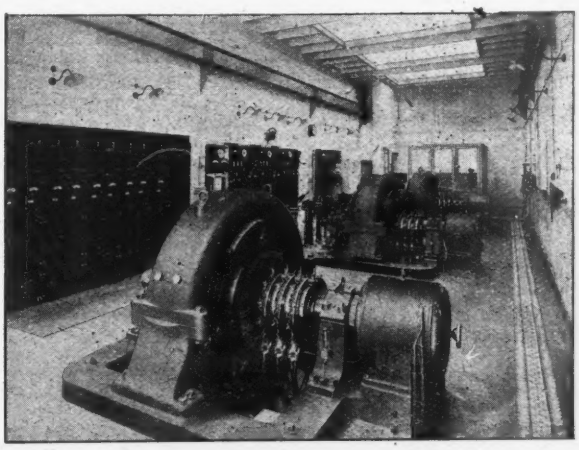


Fig. 2.—A.C. Side of Rotary Converters and "Witton" Feeder Switchboard.

Each rotary converter is provided with a slip-ring starting motor for running up to speed, synchronising being effected by operating

the rotor rheostat of the slip-ring motor. The motor is carried on an extension of the converter shaft. Suitable pillars for controlling the regulators are mounted near the switchboard, as shown in fig. 1. In addition, each rotary may be run up from the continuous current side by means of a change-over switch and starting resistance, which is similarly operated from a handwheel pillar. On the front of the board a double-pole change-over switch is also provided to reverse the shunt coil of the reverse-current trip when starting in this way.

A portion of the main switchboard controlling the low-tension side of the station is also seen in fig. 1. In fig. 2 a view of the A.C. side of the rotaries and the feeder switchboard is shown.

On the controlling switchboard each rotary converter A.C. panel is fitted with ammeter, power-factor meter, and switch and fuses for the starting motor. Adjacent to each A.C. panel is the corresponding D.C. panel, on which is mounted a circuit-breaker having overload trips as well as a tripping coil operating in conjunction with an over-speed device for each converter, in addition to the change-over switch and the single-pole main switch for starting from the continuous-current side.

A synchroscope with machine and bus-bar voltmeters is carried on a swinging bracket at the end of the board. The feeder panels are each fitted with a single-pole circuit-breaker, main switch, and ammeter.

The complete installation, as described, was supplied by the General Electric Co., Ltd., of London.

Small Commutators.

An ingenious method of constructing small commutators from round bar material is disclosed in a patent No. 1,195,861, granted to Edward F. Smith, of Cincinnati, Ohio. Copper in the shape of a cylindrical block is formed with a central bore, having countersunk recesses in its opposite flat sides and radially arranged cuts which extend in from the periphery toward this bore. These cuts are all of practically equal depth and terminate so as to leave an intact annular zone of metal around the bore, so that a blank results as shown in fig. 3. This blank is then placed in a cylinder, and dielectrical material, in plastic condition, is placed upon the

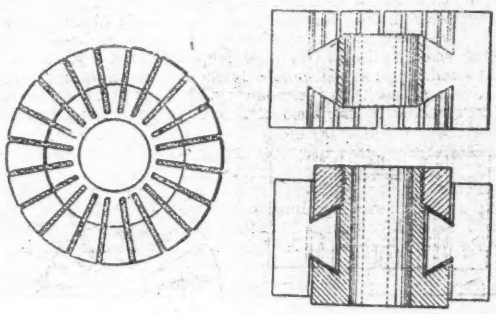


Fig. 3.—Section of Commutator Blank, Insulating Material in Place, and Section of Completed Commutator.

blank within the cylinder. By means of a plunger this material is forced against the blank so as to enter all open parts of it, the object being to fill these parts completely. The blanks are then removed from the cylinder, surplus material, especially that which fills the bore and recesses, is removed, and the blanks are set aside to permit the material to harden. Next the blanks are rebored to remove the metal within the bore, from which action finally a structure results, composed of segments all insulated from each other by the binding material. A bushing forms a bearing for the commutator.—*Electrical World.*

Improved Pocket Lamp.

The best battery and bulb fail to make up a satisfactory pocket lamp, unless a convenient and reliable switch is provided to control the connection between the two. The sliding or in-and-out switch button and spring generally provided at the side of the battery case is not above criticism. Either it fails at times to make contact with certainty, or it goes "on" unnoticed and quickly exhausts the battery. Both of these failings are particularly serious in the case of lamps to be used for military purposes; delay in obtaining light, and, worse still, the involuntary showing of a light may be fatal. To overcome these difficulties, Schneider & Co. (Frankfurt-on-Main) have patented the "Disco" lamp, in which a rotary switch is operated by a serrated ring mounted concentrically with the lamp bulb and lens on the front of the battery case, the latter being fitted with one or other of the strap attachments now usual for military lamps. The switch ring improves the appearance of the lens mounting, and is used only when the lamp is required to burn continuously. For momentary illumination or flash-signalling, a spring contact is provided at the top of the battery case. The switch ring carries a pin, which, according as the lamp is "on" or "off," engages in the recess at the corner of one or other of two springy strips at the point where the strip bends from the horizontal to the vertical. After going vertically for a short distance, the strips again turn horizontally, one below the other, thus forming the press-switch which is in parallel with the rotary switch and is used for momentary completion of the circuit.—*E.T.Z.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Centralisation of Electricity Supply.

We all believe that Mr. Williams's suggestions are made in the interests of the industry, and most of us think that much more may be done than now is being done to improve our position. Yet Mr. Williams will pardon us for examining his scheme before we give it our support.

First of all, Mr. Williams hopes to abolish the present control wielded by the Home Office, L.G.B., B. of T., and Parliament itself. But will all these authorities accept a Bill which invites them to expire and to bequeath their manifold powers to a new authority? Is it not far more likely that Parliament will hatch out a plan whereby the new governing body will, in its turn, be controlled by the H.O., L.G.B., and B. of T., and that things will be worse than ever? Above all things, Parliament is not likely to delegate its own powers to any commercial body. We must bear in mind that a large number of candidates are even now preparing to have a shot at the £400 per annum, at the election which will come after the war, and many of them have no knowledge of business at all. Not a few of them believe that Parliament should manage all business in the interest of the State, and they feel convinced that the said management can be carried out by a body of Members of Parliament who neither know nor care anything for the principles which govern business transactions. Now these gentlemen will work hand-in-hand with our Government officials to secure that no existing powers shall be abated one whit. Rather they will take advantage of the controlling Bill to take over the whole electricity supply industry.

Let us not forget the fate of the telephone. It began with many independent companies, which were eventually taken over by the National Co. According to Mr. Williams's idea, no doubt the thing should have stopped there. But it did not. The Government took it over for the benefit of the State. (It would be interesting to read some of the then Postmaster-General's speeches in the light of the present fiasco.) The State has not received benefits from the change. It has lost the rich royalties it used to get, it has raised charges to subscribers in a wholesale way, and is losing subscribers also in a wholesale way. According to the newspapers, it has lost 4,000 in London alone. Think of what that would mean to the nation if it should happen to the electrical industry. We shall do well not to tempt the next Parliament by putting any such Bill before it until we have reason to think that the members of the House are to be trusted with the responsibility.

But if we should be assured that Parliament would accept Mr. Williams's Board of Control, are we sure it would be the best thing for the industry? Mr. Williams quotes the Public Trustee as being a great success. (There are contrary opinions even on that point.) The Public Trustee is just one of those cases where the department may be run strictly on rule and red tape, and I have no doubt that all the Trustee's actions are so regulated. But the electrical industry is different. By the time the Board had got out its series of rules and regulations many of them would be out of date, and one cannot imagine a dignified Permanent Board varying its rules immediately just because some young unknown engineer, in a distant part of the land, had desired it! The Board, after 10 years, would become like a bench of bishops, wondering how new men dared to have ideas of their own, when they ought to take their opinions from the great and recognised authorities.

If we are to have a Board of Control, let us have a live one which will automatically shed its fossils and barnacles. A Board selected from the existing Councils of the large Institutions concerned, with an efficient paid staff and a laboratory, might do useful work indeed. But do not let us make the mistake of putting into its hands too much power at first. It will be far better to add to its authority when it has proved itself worthy of the confidence of the whole industry.

M. H. O.

October 16th, 1916.

Coal Economy.

One does not have much time nowadays to wade through long papers, speeches and addresses, and the pithy summaries you are accustomed to give of these are extremely valuable. In one of your leaders of this week, under the above heading, you make a note on Mr. Chattock's valuable address to the Birmingham Association of Mechanical Engineers, pointing out that he suggests "that some of the boilers in a large pit-mouth generating station should be fired with coke obtained from the distillation of coal, or, as an alternative, that coke might be gasified in producers, the advantage of the latter being uniformity in the firing of boilers and the avoidance of the difficulties met with in burning coke in boiler furnaces."

The great advantage, however, of gasifying coke, instead of burning it, is that from 30 to 60 lb. of ammonium sulphate can be recovered per ton of coke gasified, because it contains from ½ to 1 per cent. of nitrogen. It is true that if we distil coal and burn only coke and gas, we have gone a tremendously long way in preserving the by-products of coal, but in big power stations, where large quantities of gas would be required, there is no doubt whatever that it would pay to gasify coke in ammonia recovery

producers. About 120,000 cb. ft. of gas is obtained per ton of fuel, with a calorific value of about 120 B.TH.U. per cb. ft.

The producer offers a superior method of firing boilers to the coke furnace. There is a lower percentage of carbon left in the ash, and the efficiency of the gas-fired boiler must also be greater than that of a coke or coal-fired boiler, because the admixture of gas and air is under much better control, and air leakage is more easily prevented, so that a gas-fired boiler ought to work under laboratory conditions almost continuously.

I have recently seen some accounts of gas-fired boilers where efficiencies have been obtained much higher than anything that can be done with coal-firing, even when the latter is carried out under test conditions; the boilers were specially designed for gas-firing, and not coal-fired boilers, adapted to gas-firing—the latter method will not give a better efficiency than coal-firing.

A. Hugh Seabrook.

St. Marylebone Electricity Supply,
October 23rd, 1916.

[We are glad that Mr. Seabrook finds our summaries useful, but may point out that his summary of our remarks (between inverted commas) is not a verbatim quotation. In his address, Mr. Chattock did not mention gas producers fed with coke, which were the subject of our own comment. We quite agree with Mr. Seabrook's remarks, and in this connection the article on gas-firing, which appears elsewhere in this issue, will be found of interest.—Eds. Elec. Rev.]

The British Mannesmann Tube Co.

I desire to draw attention to the above matter, in order to illustrate one instance where the presumably good intentions of the Public Trustee in transferring German-owned concerns into British hands have apparently miscarried.

The British Mannesmann Tube Co. was the property of German interests resident in Germany, and these interests have recently been sold by the Public Trustee to a British financial group, the first directors of which are given in the Press as follows:—

Mr. Richard S. Guinness (chairman),
Sir Robert Balfour, M.P.,
Sir Hugh Bell, and
Mr. G. Hethey (managing director).

The announcement in the Press was doubtless intended to convey the impression that this previously well-known German concern had now become British; but the real facts disclose a state of affairs quite different. In other words, whilst the ownership of the business has passed into British hands, the actual management of the business remains in the hands of individuals of German birth.

On patriotic grounds it is to be regretted that the board of this British syndicate should have appointed as one of their colleagues and managing director an individual of German birth, whose commercial career as head of the German Mannesmann interests in this country has been entirely associated with, and supported by, German interests; and that they should further allow two important positions in this company to be occupied by two sons of the said individual, of military age, born in Germany of German parents.

In other words, here we have an instance of the Public Trustee selling the German-owned company to a British financial syndicate the members of which, whether for want of knowledge of the business themselves or other motives, allow the business to be continued under the previous German-inspired management.

Apart from the question of patriotism and of the obvious desirability of cleansing our industries of German influence, it seems to me almost incomprehensible that the Public Trustee, who is apparently empowered to negotiate by private treaty for the disposal of these German-owned concerns, should not be required to satisfy himself that the sale will have the effect of converting the previous German concern into a British concern *in toto*.

E. J. Fox.

London, S.W., *October 19th*, 1916.

[Our correspondent's solicitude for the protection of British interests, especially in this particular branch of industry, is readily intelligible; but, in this instance, he appears to be "barking up the wrong tree," as the Public Trustee, we believe, has nothing to do with the *personnel* employed by the concerns which he has transferred to British ownership. As regards the nationality of the managing director, Dr. Macnamara stated in the House of Commons, on October 18th, that he was a naturalised British subject of German origin, and was assisted by his two sons, who wore the badge "On war service" issued by the Admiralty.—Eds. Elec. Rev.]

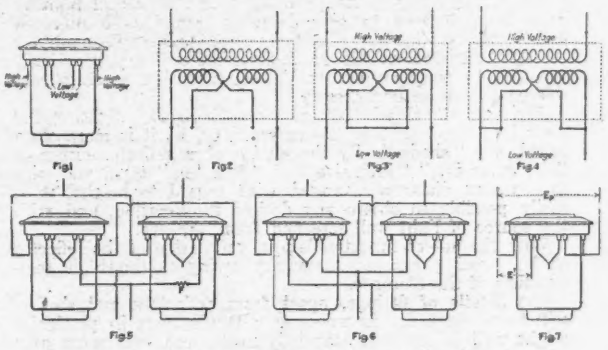
TRANSFORMERS IN PARALLEL.

The simple distributing transformer usually has two high-voltage leads and four low-voltage leads coming out from its windings, as indicated in fig. 1. The schematic diagram of the windings and the way the leads are brought out are shown in fig. 2. It will be seen that the two centre leads of the low-voltage coils are crossed inside the transformer before they are brought out through the case. This does not make any change in connecting the two sections in series on the outside of the transformer, as indicated in fig. 3, which is the same as connecting two batteries in series.

When the coils are connected in parallel, care must be exercised and adjacent leads connected together, as in fig. 4. Looking at the connections from the outside of the transformer, it would appear as though the two sections of the winding were short-circuited, but the diagram shows that the right-hand terminals of both sections are connected together, also the left-hand terminals. This is just what is done in connecting batteries or other direct-current elements in parallel—like poles are connected.

Transformers to operate in parallel should be of the same voltage, frequency and size, and possess the same characteristics, which means that they should be of the same make. In connecting transformers in parallel, it is only necessary to observe the same rules as are used for connecting two or more pieces of direct-current apparatus in parallel; namely, connect like poles to like poles. The question now arises which are like terminals on two or more transformers. This is easily determined in most cases. After the transformers are arranged symmetrically, as in fig. 5, connect the right-hand terminals together and the left-hand terminals together and bring out a lead from each junction point, as indicated.

There is, however, a chance that one of the transformers may have its leads brought out in such a way as to cause a short-circuit when the transformers are connected as shown in the figure. To



Figs. 1–7.—Transformers in Parallel.

guard against this a piece of small fuse wire may be connected, as indicated at F. If the connections are correct, the fuse will not blow when the transformers are made alive without load; otherwise the fuse will blow. In case of a wrong connection it may be remedied by crossing either the high or low-voltage leads on one of the transformers, as indicated in fig. 6. A better way would be to test the transformers and find out which has wrong polarity and correct it.

The polarity may be tested as represented in fig. 7. Connect the high-voltage terminals to the line and one terminal of the low-voltage coil to the high-voltage winding, as indicated in the figure. Measure the electromotive force at E_p and E'. If it is greater at E' than at E_p, the transformer has the correct polarity; if less, the polarity is wrong and either the high or the low-voltage leads must be crossed inside the transformer. The test may be made with 110 or 220-volt current.—*Power*.

INDUSTRIAL LIGHTING BY ELECTRICITY.*

The tendency of the present day, in arranging schemes of artificial lighting, is, as in many other matters, to endeavour to crystallise the whole matter as much as possible, and in the case of lighting into three points; that is, height of lamp or lighting "unit"; spacing distance; and the candle-power of the unit employed.

Whilst useful enough and easy of application in *new* buildings, in *old* buildings the points mentioned commonly have to be the subject of part consideration only, in order that other influencing conditions may have the necessary consideration.

A point one would specially draw attention to in this connection is the need of "general" as well as "local" or "individual" lighting in most, if not all, of the premises which the mechanical and the civil engineer have to deal with. Individual or local lighting of sufficient intensity for machine tools, benches, desks, &c., is necessary if each operator is to properly perform his duties. "General" lighting, on the other hand, is equally necessary, for by this proper supervision and discipline is possible and the safety of those persons secured who have to move about through passages and gangways. Where individual lighting is provided the value of the former is considered sufficient if of the nature of about 1.5 ft. candles

The essentials of satisfactory illumination may be summed up as comprising:—

I. Adequacy; that is to say, the *degree* of illumination produced on the working surface must be sufficient for the work or operation to be properly carried on.

*Abstract of paper read before the Junior Institution of Engineers by Frederick H. Taylor.

2. The lighting unit or source of light must be so placed that the light does not strike directly upon the eye of the operator either when he is engaged in his work or when looking horizontally across the workshop or room.

3. The lighting units should be so placed as to prevent shadows on the work or heavy shadows about those parts of the premises to which the workpeople have access.

4. Constancy, so far as the degree of illumination is concerned, is also necessary.

The value of reflection and colour in artificial illumination is commonly overlooked. The experiments carried out at the National Physical Laboratory by the Home Office Departmental Committee, in a room specially fitted out with different methods of lighting, may here be cited.

Three systems of lighting were tried:—Direct, indirect, and shielded. With the walls blackened instead of whitened, the reduction in illumination at the centre of the room was approximately 25 per cent. for direct lighting; 7 per cent. for indirect lighting, and negligible for shielded lighting. The influence of colour in artificial lighting is also often overlooked.

The effect of mental depression on remaining under blueish light for any length of time in some persons is most noticeable. Mercury vapour lamps when used for general lighting have been noticed to give different results with different people, where all other conditions were equal; one man, for example, insisted on the addition of an ordinary glow-lamp in order to carry on his work, whereas other workers considered this quite unnecessary.

Obviously for either "direct" or "indirect' lighting the most important item is the reflector, or, as it is more often called, the "shade." By the choice of a reflector either of the "extensive," "intensive," or "focusing" type, and with the spacing distance arranged with regard to height, it is easily possible to obtain any desired illumination, and with the source of light well screened from the eye.

With the use of tungsten lamps, ventilation of the reflector or lamp-fitting becomes necessary owing to the high temperature of the filament.

The details of fittings, apart from reflectors and shades, still leave room for improvement; lampholders in particular might well be more substantially made, and with more area of contact in the electrical parts.

Flexible cords for pendant fittings are frequently either poor in quality or deficient in section, or both, and frequently a good cord is used in an unsuitable position.

Proper systematic maintenance of electric lighting installations is a matter which, in this country, has received but the scantiest of attention. If considered properly, the lighting is virtually a tool, one of the tools necessary to the work going on, and this work cannot be properly and economically done if this tool is to be allowed to fall into utter deterioration. The cost of lighting commonly bears but a very small proportion indeed to the total stand-by, or "deadrent" charges of the establishment, and this cost could only be increased by an inappreciable amount when the cost of systematic maintenance is added.

Maintenance contracts when carried out by general electrical contractors should include a half-yearly test and report upon the insulation resistance of the job, a point by point test of the earthing of all metal work, checking of the supply company's meter readings and quarterly charges, and might also, in many instances, justly provide for a guaranteed minimum illumination in foot candles to be maintained in specified areas or places. From a test published concerning a factory installation, the deterioration in lighting due to dust and dirt over a period of 48 days was as follows:—Starting from an initial illumination of 4 ft. candles, at the end of six days this had become 2.8, at 18 days 2.2, at 36 days 2.1, and at 48 days 2. Glass reflectors were used.

The opportunity is sometimes presented of choosing between a D.C. supply and an A.C. So far as the ordinary working voltages are concerned, there is little to choose between them, if metal filament lamps, either of the vacuum or the gas-filled type, are used. If small candle-power lamps of the ½-watt type are essential, and alternating current is available, a static transformer may be used to convert down from a higher voltage to, say, 50 volts when lamps of the 30- and 60-watt sizes become available for parallel operation, but such cases require careful consideration if the runs of the wiring are of considerable length, as the voltage drop may necessitate unusually heavy conductors. For arc lighting one generally prefers a D.C. supply. With low periodicities fluctuations in light are well known in A.C. arc circuits.

Proper switch control of lighting is a matter well worthy of more careful consideration than it usually receives, and this would result in added convenience and economy. The points one has in mind are:—(*a*) A more liberal use of switches, (*b*) better location, and (*c*) the use of two or three point control.

For individual or local lighting, the switches should be as conveniently near as possible to the lamps controlled. These can be further controlled by a master-switch or switches placed conveniently for use by the shop-foreman, who would also control the "general lighting." In some cases it is a great convenience to be able to control one or more lights from two or more positions.

Switches in factories commonly suffer from lack of adequate mechanical protection. Where conduit wiring is adopted, iron switch boxes which absolutely protect the switch and only leave the knob projecting are to be preferred. Owing to its light construction, the ordinary "5-ampere" switch, even if only loaded to less than half this amount, is, at modern voltages, liable to rapid wear. The author has often found it pay well to adopt switches rated at 10 amps. for 2- or 3-amp. circuits on this account.

For factory use, screwed tube is very largely used, as affording a good mechanical job as well as a sound one electrically. From a fire risk point of view, it is obviously beyond question.

It should preferably be kept clear of all other metal work, be made electrically and mechanically continuous throughout, and properly earthed at least at one point.

When placed well out of reach, and in dry situations, open cleat wiring may often be used very successfully to form a cheap job.

With a view to maintaining efficiency in the lighting, attention may well be given to the following details in the circuit wiring:—

1. "General" lighting to be circuited separately from the local lighting, and, where possible, alternate units to form a circuit.

2. A more liberal allowance in the number of circuits or "ways" per distribution board should be adopted, thus insuring a minimum of the lighting units being out of action in the event of a circuit fuse blowing.

3. Motor circuits to be entirely distinct from those supplying lighting, both as regards wiring and the fusing at main or sub-main distributing boards.

INDUSTRIAL FATIGUE.

In continuation of his investigation of industrial fatigue by physiological methods, Dr. A. F. Stanley Kent recently submitted a second interim report to the Chief Inspector of Factories, which is of great interest and value to the managers of manufacturing and allied concerns. The experiments, which included a variety of simple tests designed to indicate the condition at any moment of the acuity of hearing and of sight, the blood-pressure, and the general response of the worker's organism to an external stimulus involving a "complex reaction," were carried on at seven factories during the past year, the industries employing both male and female labour, and covering a wide range of operations, including light and heavy engineering. The observations were directed primarily to the attainment of the maximum efficiency and output of munition factories, consistently with the maintenance of the health and energy of the workers, but obviously apply generally to manufacturing industries.

Dr. Kent lays special stress on the progressive development of fatigue throughout the week, and on the concomitant diminution in the power of recovery, the disadvantage of working overtime on consecutive days, and the development of fatigue during day and night shifts, and discusses also the process of recovery from fatigue under different conditions. The variation in rate of output of repetition workers throughout the day and the week, as shown in curves and charts, presents remarkable features, particularly in connection with the effect of overtime, which always appears to be accompanied by a marked fall in the rate, besides a remaining effect which reduces the rate on the following day; in fact, evidence is adduced to show that the working of overtime may lead to an actual diminution of the aggregate output. The very important influence of home conditions upon the development of fatigue and upon the output is clearly demonstrated, and the value of rest intervals is proved.

The author draws from his observations a strong argument against the practice sometimes adopted of working on Sunday; whereas in normal times the lessened efficiency found towards the end of the week is remedied by the rest obtained on Saturday afternoon and Sunday, if Sunday labour is introduced the rest period is inadequate, and the fatigue becomes permanent and cumulative, so that eventually the worker either breaks down under the strain, or, consciously or otherwise, slackens his efforts until equilibrium between fatigue and recuperation is once more attained. In either case the result is disastrous from the point of view of output, and often from the point of view of health also.

The effect of daily overtime is less marked than that of Sunday labour, though the rate of output during the overtime period has been proved to be far less than during the hours of normal labour, due, in Dr. Kent's opinion, to fatigue. Again, in factories where the output depends mainly upon the number of hours that the machinery can be kept running, and the direct influence of the operatives is small, it may be desirable to preserve overtime, though the introduction of a fresh shift would be preferable.

Another point that is brought out is the importance of taking food before going to work in the early morning, as regards the output obtained.

The work of investigation, which has been in progress for some years, is still going on, and now occupies the whole time of three investigators. Amongst the more important conclusions with regard to fatigue as a result of overtime are the following:—

Existing industrial conditions lead to an increase of the

normal development of fatigue and to a diminution of the normal power of recovery. Members of the office staff may show signs of fatigue and overstrain equally with the factory hands. Ordinary tests give the resultant of these two processes, which is useful practically, as indicating the existing state, or "fitness," of the worker.

Development of fatigue preponderates during labour, recovery preponderates during rest. During the day fatigue accumulates. During the night the accumulation is dissipated. Since production is greatest and recovery is least towards the end of a period, day, and week, fatigue accumulation is then at its maximum. A lengthening of period, day, or week leads to increased fatigue accumulation. The distribution of overtime days affects the result.

Under present conditions, production of fatigue becomes progressively more rapid from day to day; recovery becomes less rapid. Thus fatigue accumulates, and "balancing," which tends to diminish fatigue by diminishing application, is introduced. Production and recovery are restored to the normal, and accumulated fatigue is dissipated, by the week-end rest. Where the week-end rest is suspended, fatigue will persist. Residual fatigue, resulting from inadequate rest, leads to lowered efficiency and lessened output.

Overtime labour, when performed by a tired worker, results in an amount of fatigue out of proportion to the length and severity of the labour. Fatigue production is increased and recovery is lessened by overtime. The fatigue which follows a period of overtime is influenced by the previous condition of the worker. An increase in the amount of overtime worked in a given period will produce an increase of fatigue out of proportion to the increased time. Overtime periods worked on consecutive days produce more fatigue than if separated by days of ordinary length. Overtime introduced late in the week produces more fatigue than if introduced earlier. Overtime, even when not leading to injurious fatigue, is deleterious to health as necessitating long hours spent in the atmosphere and surroundings of the mill, interference with meals, sleep, relaxation, and exercise in the open air. The effect of overtime is not confined to the days on which it is worked. In the great majority of cases investigated, overtime was not desired by the workers. The harmful effect of overtime may be accentuated by the presence of unfriendly supervisors. Overtime labour is physiologically and economically extravagant. It frequently fails in achieving its object.

Labour performed at night may be regarded as analogous to overtime labour. It is performed at unusual hours. Its effect in producing fatigue may be greater than that of a similar task performed during the day. This effect appears to be modified after the night work has been in progress for some days, owing to an adaptation of the normal diurnal variations of the worker to the new conditions. For this reason a weekly change from day shift to night shift and *vice versâ* appears to be unduly frequent. The difficulty of obtaining satisfactory sleep by day affects the result.

These conclusions do not relate to excessive overtime, but to two hours added to the normal day on two or three days a week—Sunday being a rest-day. Remarking that the fatigue manifested indicates that overtime labour is more harmful to the worker than labour performed during ordinary hours, Dr. Kent points out that it is physiologically extravagant; it is also economically extravagant, for higher wages are paid for overtime, though even higher wages are not sufficient to make it universally desired by the workers.

Comparing day and night work, it was observed that the degree of fatigue developed was greater during the night shift than during the day. This is largely due to the inadequacy of the rest obtained in the day time, all the men examined stating that they slept well by night but badly by day, as might be expected in view of the difficulty of securing favourable conditions in a workman's home. It appears likely that, as there is a gradual adjustment of the organism to night work, tending to lessened fatigue, the period over which the day or night shift is worked by individual men might with advantage be lengthened.

It is interesting to note that, despite the Sunday rest, usually at the start on Monday the rate of output is distinctly low, apparently due to the temporary loss or weakening of the habit of working, and the necessity for an effort on the part of the worker to overcome the disinclination to work; the same phenomenon has been observed, in lesser degree, in the early morning of each day.

A mass of detailed data is included in the report, showing some remarkable facts. For instance, the output of four workers was tabulated for each division of the day over a period of four weeks; one of these had found for herself that by working only eight hours a day she could work so much more quickly that she could easily make up for the lost time. The other three were first-class workers, working 12 hours a day, until overtime was abolished and the working day was reduced to 10 hours. It was ascertained by strict observation that the output of the 8-hour worker was greater than the average output of the 12-hour workers by more than 8 per cent.; moreover, when the 12-hour workers were put on a 10-hour day, their total output *increased* by more than 5 per cent.

The results of unsatisfactory feeding were found to be very marked, particularly in the early morning when no breakfast had been taken; increased resistance to fatigue follows improved feeding, and Dr. Kent severely criticises the diet affected by many of the workers, especially the women. The inference is that the establishment of canteens at the works, supplying wholesome food at a low price, is highly desirable, unless it is possible for the worker to obtain a satisfactory meal at her own home. Such canteens should be provided with separate tables, and should be managed by a committee of the workers.

As the output of a factory depends upon many considerations, including the nature of the operations and the influence of the individual worker upon the volume of output, the nominal length of the working day, the actual hours worked, &c., Dr. Kent lays down no rule as to the method of attaining the maximum output, but states that this is a matter of the accurate adjustment of the factors concerned, based upon exhaustive investigation and patient experiment—particularly in connection with the actual time worked, and the actual rate of working. As for the effect of overtime upon the general health of the worker, a difficult subject for investigation, an estimate has been formed by comparing the results given by the same individual at different periods, under different conditions, thus avoiding the very unreliable course of comparing the health of one person with that of another. During a period of several weeks, whilst the working hours were changed from 12 and 10 to eight hours, in each case that was examined, the suspension of overtime was followed by a measured improvement in the general condition of the worker, and in nearly all cases the reduction of the working time from 10 to eight hours by omitting the early morning period brought about a further improvement, but of much less magnitude. Similarly, it was found that the loss of time by workers during their working hours was materially diminished when the working hours were shortened, being reduced from 19.5 per cent. to 15 per cent. on the suppression of overtime in the case of a group of workpeople, and further to 13.3 per cent. on reducing the hours to eight per day.

WAR ITEMS.

Prohibited Exports.—A Proclamation has been issued adding the following, among other headings, to those already included under the Exportation Prohibition Acts:—

Copper wires and cables containing copper.

Rubber, gutta-percha, or balata goods made wholly or partly of (except rubber hose, armoured or reinforced with steel or iron wire).

A.E.G. Shipbuilding.—According to the Berne correspondent of the *Morning Post*, a German newspaper says that the object of the Hamburg Shipbuilding Yard, founded by the Hamburg-Amerika Line and the Allgemeine Electricitäts Gesellschaft, is mainly the construction of a series of fast cargo boats, all of the same type, and such as have hitherto been a monopoly of English shipbuilders. Shipbuilders, industrialists, and financiers are collaborating in providing means for the resumption of peace work.

A Metals Committee.—The President of the Board of Trade has appointed Sir Gerard Albert Muntz, Bart. (chairman), Mr. Cecil Lindsay Budd, Mr. Clive Cookson, Mr. Charles William Fielding, Lieut.-Colonel A. J. Foster, Mr. Andrew Wilson Tait, and Mr. Alfred Harold Wiggin, J.P., to be a committee to consider the position after the war, especially in relation to international competition, of the lead, copper, tin, and such other of the non-ferrous metal trades as may be referred to the Committee, and to report what measures, if any, are necessary or desirable to safeguard that position. The secretary of the Committee is Mr. James F. Ronca, to whom all communications relating to the Committee should be addressed at 7, Whitehall Gardens, S.W.

Sale of Enemy Goods in Australia.—An Australian newspaper states that the Attorney General (Mr. Hughes) decided last month owing to his having been unable, through pressure of business, to receive the proposed deputation from merchants regarding the sale of goods of enemy origin, to extend for one month in each case the time within which, as already announced, such goods may be offered for sale. It was pointed out that the last dates within which sales may be made are therefore as follows:—In the case of sales by wholesale houses, October 31st; in the case of sales by retailers, December 31st. This announcement was not to be taken as in any way permitting the sale at the present time of goods bearing enemy trade marks which have been suspended.

In reply to a deputation representing the Australian Association of British Manufacturers and their representatives, the Minister of Customs (Mr. Tudor) said that regarding enemy goods, commercial men said it was impossible to sell articles if they were known to be of enemy origin. The Government had a quantity of German goods which had been seized at the outbreak of the war, and he was told that only a very low price would be obtained for them. The department was doing all in its power to prevent dumping by the Americans, and was sending two men to the United States to verify invoices. He was strongly in favour of *ad valorem* duties, believing that the most expensive articles should pay the highest rate. He promised to consider the requests of the deputation when the tariff was being considered.

To be Wound Up.—The Board of Trade has issued orders under the Trading with the Enemy Amendment Act requiring the following to be wound up:—

Kampe & Co., 2, Sandland Street, Red Lion Street, High Holborn, London, W.C., machinery merchants. Controller: T. A. Fox, 79, Mark Lane, E.C.

Burstinghaus & Co., Ltd., 41, Eastcheap, London, E.C., agency and hardware business. Controller: A. J. Foster, 37, Wallbrook, E.C.

United Carborundum & Electrite Works, Ltd., Apollo Works, New Southgate, London, N., agents for the sale of machinery. Controller: C. Eves, 62, New Broad Street, E.C.

Books for British Prisoners of War.—The Committee of the Board of Education which deals with this subject has sent us a classified list of books, each item of which represents an actual request received from some British prisoner. The following are included in the engineering sections:—Submarine Cables; Cable Testing; Electric Brake (Westinghouse); Electric Currents (Fleming); Dynamo-Electrical Machinery (Thompson); Modern Electric Practice (Maclean); Handbook of Electricity; Electrical Engineering (Slingo and Brooker); Alternating-current Machinery; Country House Electric Lighting Plant; Hydro-electric Power Transmission; Electric Tramways; Technical Electricity (Davidge); Magneto Ignition (Hibbert); Electrical Engineering Applied to Mining; Internal-combustion Engines; Diesel Oil Engines; Principles of Electricity (Campbell); Gyroscopic Compasses and Stabilisers; Telegraphy and Telephony (Herbert); Telegraphy (Morse); Wireless Telegraphy (Fortescue and Stanley); Post Office Technical Book (Herbert). Any of our readers who can supply one or more of these books are requested to communicate with Mr. A. T. Davies, Board of Education, Whitehall, S.W., but not to dispatch any books until notified that they are still required, as they may have been received from other sources. Donations to the funds will be welcomed. Those who have books to spare which are not named above should send a list of them, with their name and address written at the top.

Women Tramcar Drivers.—The question of the substitution of female labour for that of men in driving tramcars arose at Keighley Tribunal last week, when Mr. H. Webber, the borough electrical engineer, appealed for five tram drivers. Mr. Webber agreed that it would be possible to train women for the work, but he expected they would have the same trouble as had occurred in London, where there had been a strike on the question, because the Tramway and Vehicle Workers' Union were opposed to the substitution. In Keighley women could be trained in about a fortnight. Keighley, he said, was about the simplest place in the country in which to run a tramcar. They had been in communication with the men's Union, having interviewed a secretary about a month ago. The Chairman pointed out that each of the five men was under 30 years of age, but Mr. Webber said they had all been medically rejected. Personally, he would be quite prepared to introduce women drivers if the Union would agree, though, of course, he could not say exactly how his Committee would feel about it. He believed there were women drivers at Blackpool, and in some parts of Scotland. He would be prepared to recommend the Tramways Committee to fit glass fronts on the cars if they were considered necessary for the protection of women drivers in winter, though at Sheffield an experiment of the kind had been withdrawn at the request of the drivers themselves. The cases were adjourned. At the same hearing, Mr. Webber appealed for a clerk in the electricity department, who said he only weighed seven stone, and measured 27 in. round the chest and 29 in. expanded. It seemed he had been rejected twice, and he did the whole of the clerical work with the assistance only of a boy and a girl. A fit clerk had joined the Army, and the removal of this man would impose serious extra work on the engineer. The clerk was measured before the Tribunal, and his chest was found to be 32 in. expanded according to the Military Representative's measurement. Exemption to January 1st was given.

Investments in Belligerent Countries.—A fresh example of the inconvenience resulting from the holding by non-belligerent countries of electrical investments in countries which are now engaged in war is afforded by the Bank fur Elektrische Unternehmungen, of Zurich, although it has to be remembered that the bank was formed originally by the Berlin A.E.G. At the recent general meeting of this institution the chairman stated that the Italian Government had just placed the Officine Elettriche Genovesi, of Genoa, and the Unione Italiana Tramways Electrici, of Genoa, under State supervision, which represented an easy sequestration, and the Government official was continually informed of the course of the business and would prevent any payment to hostile countries. The bank had asked for the diplomatic intervention of the Swiss Federal Council against this measure, because both of the Genoa undertakings were essentially of an Italian-Swiss character. Out of the 80,000 shares issued by the Officine Elettriche, the chairman remarked that 30,000 were in Italian possession, 19,950 were in the hands of the bank, 26,000 in other Swiss ownership, 2,000 in countries which are friendly towards Italy, and only 1,200 in German hands. The Teutonic holding in the Unione Italiana was also inconsiderable, and the German members of the directorates of both companies retired from the boards prior to the war. Proceeding to discuss the situation of the Russian investments, the speaker stated that the suspicion that the Petrograd Electric Light Co. of 1886 was a German undertaking had been removed, but the work of clearing up the matter had to be again commenced, owing to the frequent change of ministers. The hope, however, was justified that the company would overcome the present difficult period. The president also referred to the Imatra Co., and said that the erection of the works was impossible under existing circumstances in Russia. The Roumanian undertaking—the Electrica of Bucharest—had been placed under Government supervision; its area of supply was "not yet" included in the zone of war. In conclusion, it was mentioned that large reductions in the yield on the German investments were not to be expected, whilst the Swiss undertakings were in a very satisfactory position.

Exemption Applications.—The Smithfield Markets Electric Supply Co., Ltd., appealed at the City of London Tribunal on behalf of 16 of their employés. The men in question were J. Anthony, 29, married, wireman's mate; W. H. Allemande, shift engineer, 22, single; J. I. Biggam, shift engineer, 29, single; E. A. Copelin, driver, 26, married; W. H. Harper, shift engineer, 34, married; F. H. Tutt, foreman and meter reader, 25, single; T. F. Austin, installation and fuse attendant, 36, married; T. G. Deller, assistant driver, 40, single; H. J. Lazenbury, driver, 39, married; P. F. Roberts, shift engineer, 27; J. Richardson, wireman's mate, 27, married; C E. J. Stevens, wireman, 29, married; E. W. Warren, 33, married; S. Hidson, 36, married; A. E. Bonsor, 23, and J. O'Connell.

Mr. James (Clerk to the Tribunal) said that there had been a fire on the company's premises, and this had thrown the whole thing into confusion. Mr. Powell, for the company, said the fire had wrecked their station. They appealed for these men because they were engaged on work of public utility, and every man was absolutely necessary for the carrying on of that business.

The Chairman (Mr. Cole) said that these men were of military age, and in this combing-out process the company must get some men who were not of military age.

Mr. Powell said that they had tried to get shift engineers by advertisements and other means, but really could not get men. The only way they could get shift engineers now was, apparently, by taking them from other stations, who would then be placed in the same position. The electrical papers, he said, contained thousands (*sic.*—Editors) of advertisements for shift engineers. The company employed three drivers, but they had lost one who had unfortunately been killed by an explosion in February, and another had been away owing to an accident. As a result of the fire, Mr. Powell said, Smithfield Market was now practically in darkness.

Mr. Davis (a member of the Tribunal) said that if the place was wrecked they could not possibly be employing these men.

Mr. Powell said it was a question of getting a reinstatement of all the electrical part of the business, and he could not say how soon it would be possible to do all this. He was afraid he could not get any definite promise of delivery at all. Every one of these men were employed in the station. They could be doing work and the actual delivery of some of the goods might possibly be postponed some time, but as it was now, the station was in such confusion that the men were employed not only in the day time, but at night as well so far as it was physically possible. The company made their own power. They had five oil engines more or less constantly running, and they also had a reserve supply, which was called upon by means of four motor generators, through which they could get supplies from other companies. It was their object to restore the station as far as possible and as soon as possible, and if the Tribunal would give them time they would in all probability be able to replace every one of those men. Practically everything had been destroyed except the engines themselves. Continuing, Mr. Powell said that all these men had their separate work at the present time, and the Chairman said that might be so when the machinery was running, but not when they were trying to put the place in order.

It was stated that the recommendation of the Military authorities was that seven of the men should be postponed till March 8th, one for two months, and that the rest should go. The Tribunal, however, decided to adjourn the case for a month, the Chairman remarking that possibly half of these men might then have to go.

At Sheffield, the Wolf Safety Lamp Co. applied for exemption for J. L. Conway, 34, works manager; R. S. Harvey, 25, married, and W. Robson, 28, single, electricians. Exemption until December 31st was granted to Conway, to Harvey until November 30th, and Robson's application was disallowed.

At Farsley Tribunal, the Morley Electrical Engineering Co., Ltd., appealed for Harold Moor (25, married), Leonard Magson (30, married), John Hartley (36, single), and F. H. Platts (37, married), on the ground that they were in certified occupations. In reply to an observation by a member of the Tribunal that Moor, at 25 years of age, was rather young to be a foreman, Mr. W. Summerscales, representing the company, reminded the Tribunal that the electrical industry itself is young. There was, he said, no picking up of men of 45 years of age. A workman who learned the industry under the old *régime* was little use now, as the methods and

almost everything had completely changed. Conditional exemption to December 31st was granted in each case.

At Shipley Tribunal, Richard Lindley, electrician, said he employed four men, all of whom were ineligible. He had attested for the Navy, but his papers had been returned. They had said there must have been some misapprehension, as there was no right of appeal for men attested for the Navy. He said he had tried through the Labour Exchange to secure direct exemption because of the nature of his trade, and had been recommended to apply to the Ministry of Munitions. After two applications there he was told it was no use asking for badges when he had an appeal pending. Until he got the appeal settled the request would have to be refused. Postponement to February 28th was allowed.

Sheffield Tribunal has granted exemption until December 31st to Mr. A. B. Gott (35), electrical engineer, who appealed on business grounds.

At Folkestone, an appeal was made by F. O. Cox, electrician at the Pleasure Gardens Theatre, it being urged that it was essential for the safety of the public that a skilled man should be in charge. He was engaged when the installation was put down, and had been in charge ever since. A month was granted.

Ilfracombe Tribunal have granted exemption until March 1st to Mr. A. H. Friend, electrical engineer, who is passed in Class C 1.

At Torquay, the Corporation electricity department appealed for an employé passed for C 2. Mr. Keenan, assistant electrical engineer, said that the man was of much greater value to him than he would be in the Army, on account of his physical condition, and he urged conditional exemption. On the recommendation of the Military representative exemption was given until January 1st.

Before the Surrey Appeal Court, the Military appealed against exemption granted at Godalming to A. G. Mitchell (21), shift engineer with the Urban Electric Supply Co., Ltd., on account of age and the man not being in a certified occupation. Mr. Robertson, for the company, said that he had been unable to replace the man. Mr. Skeet: Have you tried at the various polytechnics? Surely there are a lot of young men in training there. Mr. Robertson: No; we are not allowed to employ anyone under 16 years of age. He added that Mitchell was paid 24s. per week and the bonus. Mr. Poulter: And do I understand that this man is doing what is generally done by two men? Yes. The Chairman and Captain Gerahty both expressed the opinion that if better wages were offered another man could be found, but Mr. Robertson said if he offered £3 a week he would not get anyone. Captain Gerahty: If you advertised for a C 3 man who is no use as a clerk, and offered proper wages, you would get someone. The appeal of the Military was allowed.

The Chiswick Electric Light Supply Co. appealed at Aberystwyth for extended exemption for E. R. Chamberlain, shift engineer. It was stated that before the war five men were engaged at the Aberystwyth works; now there were only two besides the manager, and if Chamberlain was taken it would be impossible to supply the town with current. The two men worked from 8 a.m. to midnight. The two apprentices they had could not possibly undertake the work. Abortive efforts had been made to find a substitute. The application was refused on condition that the calling up is not before January 1st.

Mr. G. Hitchens, of Holloway, appealed at Bath for his brother, F. J. Hitchens (38), electric fitter. On account of the classification, the appeal was withdrawn without prejudice, subject to Hitchens joining the St. John Ambulance Brigade.

Conditional exemption, owing to his being in a certified occupation, has been granted to Mr. W. A. Harwood, electrical engineer, of Hebden Bridge.

At Rugby, exemption was claimed by Mr. W. H. Linnell for H. W. Gilbert (23), electrician and wireman, passed for labour at home. He was, it was stated, the only man left in the electrical department, which would have to be closed down if he went. The Chairman observed that the firm had done very well, and exemption until January 1st was allowed. A Military appeal against temporary exemption allowed to Mr. Linnell, jun., was withdrawn, as he is entering the Army.

An appeal was made to the East Sussex Tribunal against exemption refused to Chas. Winter (41 in January), electrician at the Albany Hotel, Hastings, who, it was said, could not be replaced. The Court directed that the man should join up at the end of a month.

Temporary exemption until March 1st has been granted by the Barnstaple Tribunal to G. W. Branch (29), electrician, who is passed in Class C 3.

Gloucestershire Tribunal have withdrawn an exemption certificate granted at Cheltenham to a driver, aged 28, engaged with the Light Railway Co. The company has given up 64 out of 92 men, and the man was one of eight left who could be trusted to drive a car up Cleeve Hill. The Chairman suggested that there should be fewer opportunities for the public to ride up Cleeve Hill.

Gloucestershire Tribunal has refused exemption to the working partner (28 and single) in a Gloucester firm of electricians.

At Rawmarsh, Mr. Brown, manager of the Mexborough and Swinton Tramways, appealed for two motor-men, aged respectively 24 and 39, and a brake repairer and general assistant in the car repairing depôt. The two motor-men were conditionally exempted, as they are not passed for general service, and the other man was put back for nine weeks for a medical re-examination.

At Weston-super-Mare, absolute exemption was claimed by Mr. A. J. Kettle (33), electrical engineer, of Churchill. A month was allowed.

At Axbridge, the Winscombe Electric Light & Power Co., Ltd., appealed for Mr. W. Hill Reed (38), engineer and secretary and general manager. The company, it was stated, supplied about 130 customers in five parishes, and the concern was run not for private profit, but in the interests of the public, no dividend or directors' fees having been paid. Mr. Reed took night duty, and looked after the engines and plant in alternate weeks. The Tribunal allowed six months' exemption.

Exeter Tribunal has refused extended exemption to Mr. C. H. Steele (38), electrical engineer, and Western representative for a cable construction company.

At Oxford, the Electric Tramways Co. appealed for exemption for four drivers. The Military representative pressed for two of the men, and this course was adopted, two being conditionally exempted and two being refused any time.

At Exeter, Mr. W. J. Hall, electrician, engaged at Exwich Laundry, was allowed only 13 days' grace for his place to be filled. The Military intimated that they had five substitutes available.

At Hastings, Mr. F. Wordley, electrical engineer, appealed for R. Merrifield (39), electrical fitter, claimed to be in a certified occupation. He was given conditional exemption without time limit.

Before the Hants Appeal Court, on October 19th, the Military appealed against conditional exemption allowed to C. W. Spencer (20), with the Isle of Wight Electric Light & Power Co., at Shanklin. Lieutenant Ward contended that a man of 20, who was an apprentice, could not be considered the hub of any business, and the concern could surely be carried on without him. The manager of the works urged that Spencer was in a certified occupation. The certificate was cancelled, and three months' exemption granted.

At Ryde (Isle of Wight), Messrs. Ashton & Holt, electrical engineers, appealed for W. White (24), electrical wireman, the only man left with the firm. He was given until January 19th, with leave to appeal again.

At Gloucester, on October 18th, a firm of electricians appealed for the only electrical wireman (40) left, who was an original member of the Volunteer Training Corps. Seven men had enlisted, and the firm had several Government jobs in hand. Conditional exemption was allowed.

Teddington Tribunal on October 17th granted exemption until December 16th to E. Eddey and W. Brandon, electricians, appealed for by Mr. Langston Jones.

At Walthamstow, on October 20th, Mr. G. R. Spurr, electrical engineer to the U.D.C., appealed for a trolley-head cleaner, aged 23, and said that he was extremely short-handed, and could possibly train a man to do the work in six months. Asked if it was not possible for discharged soldiers to do the work, Mr. Spurr said that he had tried three, and the result had been most unsatisfactory. The work was actually overhauling. Exemption was refused.

At the Deeside Military Tribunal, the Marquis of Aberdeen asked for exemption for Alex. Gordon, electrician, The Lodge, Tarland. In the opinion of the Advisory Committee this was not work of national importance. The Factor said they had tried a man who took funk at the engine and gave up the job. This was the only man round about the place. There was great danger in doing the work with a new and inexperienced man. He asked for temporary exemption. The claim was dismissed.

LEGAL.

Remy Magnetos Dispute.

A dispute with regard to the sale in this country of the Remy magnetos manufactured by the Remy Electric Co., of America, was settled before Mr. Justice Darling in the King's Bench Division. Mr. Walter H. Johnson and the Imperial Motor Industries, Ltd., were sued by Smith & Sons (Motor Accessories), Ltd., for an alleged breach of a contract by which Smith & Sons were to have an exclusive agency for the sale of the Remy magnetos in England. It was alleged that the defendant company had induced Mr. Johnson to break his contract with the plaintiffs, and conspiracy was alleged. The contract was disputed and the conspiracy denied. Mr. Gordon Stewart, K.C., and Mr. Charles Doughty appeared for the plaintiffs, and the defendants were represented by Sir John Simon, K.C., Mr. Ernest Pollock, K.C., Mr. Neilson and Mr. Douglas Hogg.

In the course of the case Mr. Stewart stated that one result of the defendants' action was that on certain magnetos purchased by the Mechanical Transport Department of the War Office the plaintiffs would have made a profit of £11,775, whereas the defendants' margin of profit was £25,000.

At the conclusion of the plaintiffs' case his Lordship held that there was no evidence of conspiracy, and that there was no case to go to the jury against the Imperial Motor Industries.

On that holding the parties agreed that judgment should be entered for the plaintiff company against Mr. Johnson for an agreed sum.

Electrical Companies' Litigation.

The action by the British Thomson-Houston Co., Ltd., against the A. and A. Electrical Co., Ltd., which stood third in the list of cases to be heard by Mr. Justice Sargant in the Chancery Division, was mentioned to his Lordship on Thursday, last week, on an application to fix a day for the hearing. Counsel for the defendants applied that the case should not be taken before November 8th, the reason being that Mr. Dane, the solicitor for the defendants, had been called up on military service, and it was necessary for some one to take up the case; and that Mr. Russell Clarke, counsel for the defendants, was at present on Admiralty service, and hoped to be free in three weeks' time.

Mr. Gray, for the plaintiffs, assented, and his Lordship acceded to the application.

Works Manager Fined.

We read in a provincial paper that at a northern town, on Saturday, the manager of a works engaged on the production of war material was fined £10 and costs for failing to have a responsible person in charge to receive official messages. The chief constable said the firm promised to comply with the conditions attached to exemption. On a particular night no reply was received to telephone calls to the works, which were later found to be closed. The negligence of the defendant in not informing the police might have led to endless confusion.

Tampering with a Fuse Box.

At the Highgate Petty Sessions last week, before Mr. Walter Reynolds and other magistrates, Frederick John Beaumont was summoned for wilfully injuring a fuse-box and other electrical fittings belonging to the Hornsey Corporation.

Mr. Tatham, for the Hornsey Borough Council, said that about eight o'clock on the night of the 2nd inst. Mr. Staniland, the borough electrical engineer, noticed at his private house that the light was "jumpy," and, thinking something might be wrong, he telephoned to the works. The same thing had been noticed there, and the staff were on their guard. About 9.40 p.m. defendant rang up to say his fuse had "gone," and he asked that a man might go round to put it right. Having regard to the fact that there was something wrong with the light, he was told that a man could not be sent that night but that one would call in the morning. On the following day an inspector called and found the Council's fuse-box had been broken open. There were two fuse-boxes; a consumer might touch his own but not the Council's. There was a red notice stating that this was the property of the Council and must not be interfered with. To do so might cause very serious damage: it might put out the electric lighting of that part of the district, and some hours might elapse before it could be put right.

Giving evidence in support of this statement, Mr. Staniland said that on the following day he called on Mr. Beaumont, who admitted he had put a fuse in the box, which was badly knocked about and burnt. Explaining what occurred, witness said that defendant's fuse had "gone," and then apparently the Council's. The latter was of fine wire for safety's sake, but defendant had put in a dangerously thick wire and actually soldered it. When the fuses went defendant would have no supply, and he tried to restore it. The variations of the pressure on that circuit were due to his inexperienced manipulation of the fuse. The cost of repairs, &c., had been £2 7s. 7½d., and that of keeping an engine running and extra time of the staff—as it was thought there was mains trouble—£1.

Mr. R. Moritz, chairman of the Electricity Supply Committee of the Council, said they had had several of these cases during the six years he had held the position, and they were reluctantly compelled to bring a case to court.

The Chairman: We feel that this is a serious matter, and we must inflict the full penalty of £5.

The Clerk doubted whether the magistrates could also order the payment of the £3 7s. 7½d. on that summons.

Mr. Tatham said that as the penalty would go to the Council he was content, and he did not ask for solicitor's costs.—*Hornsey Journal.*

A Deal in Marconi Shares.—Litigation at an End.

An action which has been pending for a long time in the Chancery Division over a deal in a large block of shares in the Marconi Wireless Telegraph Co. of America was settled on Monday. Mr. Justice Sargant was to have heard a motion on that day, in which the defendants to the action (Mr. Godfrey Isaacs, Mr. G. Marconi, and the directors of the Marconi Wireless Telegraph Co., Ltd.) were to apply to the Court to strike out the statement of claim in the action on the ground that it showed no reasonable cause of action. The plaintiffs who were respondents to this motion were Mr. Locker-Lampson, M.P., and Lieutenant Wright, suing on behalf of themselves and all other shareholders of the English Marconi Co., except such as were defendants. The object of the action was to secure to the shareholders the benefit of the "deal." Among counsel briefed in the case were Mr. P. O. Lawrence, K.C., Mr. Upjohn, K.C., Mr. Romer, K.C., for the plaintiff respondents; and Sir J. Simon, K.C., M.P., Mr. Gore-Browne, K.C., Mr. F. Russell, K.C., Mr. Tomlin, K.C., and Mr. Maugham, K.C., for the defendants and applicants.

Mr. Gore-Browne had just opened the motion in his charge, stating that there were several others all exactly the same, when he was interrupted by a communication, and he broke off his statement, and told the Judge that the case had been settled by the parties outside the Court.

Mr. Upjohn said no word of a settlement had reached the other side.

Sir J. Simon, who had just come into Court, said an arrangement had been come to by the parties, for which none of the counsel in the case could be charged with any responsibility. They had arranged, subject to his Lordship's approval, that the action should be disposed of by an order, such as the motion asked for, staying all proceedings on terms agreed.

An order was made as asked.

Stubbs *v.* British Electrical Federation, Ltd.

The British Electrical Federation, Ltd., were on Monday defendants in an action by Mr. John Stevenson Stubbs, an advertising contractor of Liverpool, heard before Mr. Pollock, one of the High Courts Official Referees, in which he claimed a balance of commission upon certain advertising contracts obtained by him for the Federation. He also asked for an account of moneys received on account of advertisements up to the date of the determination of his contract. The terms of the plaintiff's contract with the defendants were that he was to receive a salary of £400 a year and commission at the rate of 5 per cent. upon receipts up to £4,000 a year, above £4,000 and up to £7,000, 4 per cent., above £7,000, and up to £10,000, 3 per cent., and over £10,000 2½ per cent. The employment came to an end in 1914, and plaintiff alleged that he had not been paid the full commission as agreed. Since the action was commenced the account claimed had been furnished to the plaintiff, and the question between the parties was whether contracts made during the three years of engagement continued chargeable to commission after the three years had expired. Evidence was called on both sides, and, in the result, the Referee found that the plaintiff had received all the money due to him, and gave judgment for the defendants, with costs.

BUSINESS NOTES.

Catalogues and Lists.—British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Three new publications: Supply List No. 150/2 gives particulars and prices of electric cooking and heating apparatus and "Utility" motors; Supply List No. 181/2 contains illustrated descriptions and prices of electric vacuum and suction cleaners ("Premier," "Imperial," "Little Briton," "Simplex," and "Briton"); and Control Catalogue No. 76/1B, dealing with resistance units for alternating or direct current circuits.

General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Folder, giving illustrations and prices of a series of the "Good Citizen" anti-Zepp. lamp shades. These shades are of cardboard, and instead of being fixed to the lampholder, are held by cords, which are tied to the flexible wire above the lamp at the height necessary to screen the rays from the window. They are made in various sizes and shapes, and in various tints. The shades have been designed to meet the lighting regulations without shutting off more light than is absolutely necessary.

"Z" Electric Lamp Manufacturing Co., Ltd., Southfields, London, S.W.—New season's catalogue (16 pages) of a wide range of "Z" drawn-wire lamps, from a pocket-lamp bulb to a 1,500-watt "half-watt." Prices are tabulated of one-watt lamps, plain and twisted candle lamps, "Zedlite" candles, traction lamps, train-lighting lamps; also half-watt lamps, motor-car type lamps, sign and illumination type, flashlight type, and "Penlite" pocket torches. Copies will be sent to anybody in the trade on application.

The Endolithic Manufacturing Co, Ltd., 61½, Fore Street, E.C.—List of articles made by the company, and coloured leaflet illustrating examples of metal and other labels for machinery, switchgear, and other purposes.

Credenda Conduits Co., Ltd., Chester Street, Aston, Birmingham.—Two folders giving brief particulars and prices of (1) special lines in domestic electric heating and cooking apparatus; (2) Credenda conduits and fittings.

Crompton & Co., Ltd., Chelmsford.—20-page Projector list (P 1), giving full particulars of their standard searchlight projectors of various types and sizes. The list is excellently illustrated.

Bankruptcy Proceedings.—A. F. Hawdon, electrical engineer, Gosforth.—Third and final dividend, 1s. ¾d. in the £, payable October 26th, at the Official Receiver's Office, 30, Mosley Street, Newcastle-upon-Tyne.

Patent Restorations.—An order has been made restoring Letters Patent No. 13,719, of 1908, granted to J. C. B. Ingleby for "Improvements in or relating to squirrel-cage rotors for induction motors and alternators."

Orders have been made restoring the following Letters Patent granted to Carl Eloesser:—

No. 22,472, of 1907, for "Improvements in power transmission gearing."

No. 18,169, of 1908, for "Improvements relating to endless metal driving-bands."

No. 18,170, of 1908, for "Improvements relating to endless metal driving-bands."

Dissolution.—Richards & Rhodes, electrical engineers, Station Buildings, Keighley.—Messrs. S. Richards & J. S. Rhodes have dissolved partnership. Mr. Richards will attend to debts, &c., and continue the business under his own name.

Trade Announcements.—Messrs. Sherrington, electricians, have opened new showroom premises at 221A, Lord Street, Southport.

The Mica Manufacturing Co., of Volta Works, Cazenove Road, Stoke Newington, N., write to point out that the Mica Manufacturing Co., which, as stated in our issue of October 13th, has been struck off the register, is a concern which ceased to exist many years ago. The present company was in no way connected with that business.

Mr. Sherard Cowper-Coles, who has severed his connection with the Homogeneous Lead Coating Co., announces that he is carrying on his business at 1, French Street, Sunbury-on-Thames.

Book Notices.—"Income-tax in Relation to Local Authorities." By F. Ogden Whiteley and W. Whittingham. Bradford: W. Byles & Sons, Ltd. Price 10s. 6d.

Beama Journal. No. 4. Vol. II. October, 1916. London: Oakley House, Bloomsbury Street, W.C. Price 1s. net.

"How to Make Low-pressure Transformers." Third Edition. By Prof. F. E. Austin. London: E. and F. N. Spon, Ltd. Price 2s.

"Telegraphy." By T. E. Herbert. London: Whittaker & Co. Price 9s. net.

A Trade Bank in Spain.—A Bill is to be presented to the Spanish Cortes for the establishment of a bank for foreign trade. To be known as the Banco Espanol de Commercio Exterior, the objects of the new institution are to be:—The granting of credit to facilitate the export of goods of all kinds and the import of raw materials and accessories for agriculture and the national industries; the discount, purchase and sale of international drafts in any currency; the opening of credits in foreign money for operations abroad; the nationalisation of acceptances and drafts resulting from the importation of foreign merchandise, warehouses and of free zones; the formation of information bureaus and commercial museums; the granting of loans for guaranteeing vessels; and maritime insurance. The capital is to be not less than £1,500,000, to be subscribed by the banks and the public.—*Financial Times.*

Switching Examination.—Messrs. A. P. Lundberg and Sons have just got out a new edition of their Exam. Folder, affording particulars of their free examinations in electric-light switching. The unsolicited expressions of opinion from examinees given therein make interesting reading, and a reference is made to the good opinions of central-station chief engineers, and professors and teachers, which appear in other of the firm's publications, which go to show that the subject of electric-light switching has fully justified its claim to be an important branch of electrical installation work.

For Sale.—Llandilo U.D.C. is offering a D.C. steam generating set for sale. Messrs. Shirlaw Allen & Co. are shortly to sell by auction certain plant, material, &c., under the winding-up of the Phœnix Electrical Co. and the Caledon Electrical Co. Particulars will be found in our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Accrington.—Wages.—The Electricity Committee has granted increased wages to certain employés, representing an average increase of 20 per cent. on pre-war rates.

Barnes.—Loan Application.—The U.D.C. is to apply to the L.G.B. for permission to borrow £2,000 for house services, on account of the £5,000 sanction for this purpose in January, 1914.

Bingley.—Power Charges.—At a meeting of the District Council, last week, attention was called by Mr. Turner to the higher charges for electric current for motive power at Bingley, as compared with those at Keighley, the neighbouring town. He complained that, though £8,000 had been spent in equipment, all the department seemed to cater for was household consumers. It was intimated that the matter would be put before the Electricity Committee for consideration.

Bognor.—The Electricity Co. has intimated its decision to charge every consumer for a minimum of 20 units per quarter. The matter has come before the U.D.C., which has referred it for consideration to the Legal Committee.

Bradford.—Linking-up.—The Electricity Committee has authorised Mr. T. Roles, the engineer, to attend the meeting to be held in Leeds, for the purpose of appointing a local Committee for the area in connection with the scheme of linking-up electric supply undertakings.

Continental.—Germany.—It was officially announced in July that the Rheinisch Westfalisches Elektrizitätswerk had been granted permission by the Government to construct three 100,000-volt overhead mains in different districts. Although no reference to this matter is contained in the annual report for 1915-16 of this great undertaking for the supply of electricity and gas, it is stated that the 100,000-volt iron main leading to the district of Crefeld has been constantly in service since October, 1915, and it may, therefore, be assumed that the three new mains for the same voltage will also be of iron or steel. The report mentions that the total connections of the company's works and its associated works of Berggeist, of Bruhl, the Bergische Works, of Reisholz, and the Bergische Works, of Lenner, increased from 357,000 kw. in 1914-15 to 400,000 in 1915, of which 212,160 kw. applied to the Rhein. Westf. Works. The number of glow lamp connections rose from 1,400,000 to 1,500,000, and the motors from 37,000 to 38,000 in the two years respectively, whilst the sales advanced from 293,000,000 kw.-hours to 388,118,000 kw.-hours. In addition, the sales of gas, which was supplied through a long-distance network of 127 miles, increased from 26,855,000 cb. metres to 33,945,000 cb. metres, and 5,019,000 cb. metres of gas were also supplied by the gas works managed by the company. The net profits realised in 1915-16 reached £222,000, or approximately the same as in the preceding year, and the dividend at 8 per cent. on the ordinary share capital of £2,500,000 (apart from loans of £1,820,000) is the same as in 1914-15. A less important undertaking—that of the Elektrizitätswerk Westfalen, of Bochum—also had a larger turnover in 1915-16, the sales having risen from 43,776,000 kw.-hours in 1914-15 to 55,150,000 kw.-hours last year. The net profits amounted to £26,000, as compared with £25,000 in 1914-15, and the dividend is 6 per cent. as in the preceding year. The sales of the Hamburg Electricity Works increased to a still greater extent—namely, from 43,453,000 kw.-hours in 1914-15 to 63,447,000 kw.-hours last year, but the net profits declined from £167,000 to £88,000, and the rate of dividend on the ordinary capital of £1,100,000 (exclusive of preference shares and loans of £500,000) receded from 11¾ per cent. in 1914-15 to 6 per cent. last year.

Russia.—According to the "Pravitelstvennei Vyestnik," a large electrical undertaking is being founded in Southern "Esterbothnia," in which three towns and 28 rural districts are concerned. It is intended to form a company for carrying out the project, and to set up four stations for the generation of electrical power, viz., at Sturo, Ilistaro, Kurikka and Alavu. It is proposed to absorb all the small electrical undertakings at present existing in these districts. In the region covered by the operations of the new company there are many waterfalls and extensive peat deposits which will make it possible for power to be generated at a moderate price.—*Board of Trade Journal.*

Eastbourne.—Bonuses.—The whole of the Corporation electrical staff is to receive an additional war bonus of a 1s. per week. This will entail an additional expenditure of approximately £88 per annum, and a total increase under this heading since the commencement of the war of approximately £250.

Elland.—Price Increase.—The U.D.C. has intimated that the price of electric current will be increased to 5d. per unit for lighting and for power purposes by 7½ per cent., making a total advance of 20 per cent.

Glasgow.—Plant Shortage.—The chief engineer of the electricity department reported that the position of the department was getting serious, owing to shortage of plant to meet the continually increasing demand. The load this winter would call for the simultaneous use of practically the whole of the generating plant belonging to the Corporation, including the Pinkston power station. The installation of additional boiler plant in Pinkston station would enable the department to get through the winter of 1917-18, but generating plant of the size which must now be bought would take at least two years to get installed and running. The Committee was aware that in November, 1911, a site for a new generating station was purchased at Dalmarnock Bridge. It was agreed that this new station should be proceeded with in the beginning of 1914, with a view to having the new works running during the winter of 1916. In March and August, 1914, offers were accepted for clearing the ground and for foundations for part of the works. On the declaration of war the Corporation decided that, beyond completing the contracts which had already been placed, the erection and equipment of the works should be postponed. The department had now, however, arrived at a stage when it appeared to him that the Committee must instruct him to stop connecting new consumers, or empower him, if new consumers were to be connected, to withdraw the supply from them during the winter months, or proceed with a portion of the new generating station at Dalmarnock. Mr. Lackie appended a statement showing the maximum demand, plant capacity, and amount of spare plant in other undertakings, municipal and company-owned, which were comparable to Glasgow, as follows:—

Name of town.	Maximum demand.	Plant capacity, kw.	Spares.	Percentage of spares.
Glasgow	50,000	54,550	4,550	9 %
Birmingham ...	33,000	41,505	8,500	25 %
Edinburgh ...	11,400	20,390	8,990	80 %
Dundee	7,014	16,500	9,486	120 %
Leeds	16,700	26,600	9,900	60 %
Liverpool	23,511	44,600	21,089	90 %
Manchester ...	49,897	57,300	7,403	17 %
Sheffield	23,618	26,000	2,382	10 %
Companies.				
Charing Cross ...	12,664	26,480	13,816	100 %
Central	10,443	19,695	9,252	90 %
Chelsea	19,739	30,000	10,261	50 %
City of London ...	13,700	20,300	6,600	50 %

The Committee has been empowered to proceed with the fourth part of the Dalmarnock scheme, representing an addition of about 40,000 h.p. of plant.

Halifax.—Wages.—The T.C. has been recommended to grant a war bonus of 4s. per week, on certain conditions, to employés of the electricity department.

High Wycombe.—Public Lighting.—The Electricity Committee has accepted the offer from the T.C. of £100 per quarter for public lighting (owing to the restrictions), and 15s. per lamp per quarter for each lamp lighted, subject to the present contract being renewed for not less than seven years from the date of the removal of the restrictions. The Council has decided not to consider the question of renewing the existing contract at the present time.

Huddersfield. — Price Increase. — The Corporation electricity department has intimated an increase in the price of electricity to all consumers of a further 12½ per cent. on pre-war rates for the quarter expiring at the end of the present year.

India.—Definite progress has now been made with the electrification of the pumping plant at Hesserghatta, so far as the Bangalore City side of the scheme is concerned. It is understood that the present steam system will be replaced before the end of the official year. A return on capital outlay of as much as 30 per cent. is anticipated, that is, having regard to the saving on wood fuel, or a saving all round of fully 60 per cent., if, and when, the Station Municipality joins the scheme.—*Indian Engineering.*

Keighley.—A recommendation to expend £2,000 on the provision of E.H.T. cable for the electricity supply undertaking is to be made to the T.C.

Kilmarnock.—Extension of Supply.—A number of applications have been received by the Corporation electricity department for a supply of electricity for lighting from intending consumers in Troon, and the manager is negotiating for an overhead line extension.

London.—St. Pancras.—The Electricity Committee has declined to share the expense of changing over the University College supply from 110 to 220 volts.

The Committee has authorised the substitution of further arc lamps by 100 half-watt lamps, at an estimated cost of £325.

Application is to be made to the L.C.C. for sanction to the borrowing of £11,934, the estimated capital expenditure on the electricity undertaking to March 31st, 1917.

The Committee has agreed to a general increase in wages of the electricity employés for the period of the war.

Southwark.—The borough engineer is to purchase a new motor for the crushing plant at Manor Place depôt, at not exceeding £150.

Manchester.—Daylight Saving.—The returns of the electricity department on the effect of the Daylight Savings Act show that for the quarter ended September 30th, the actual consumption for lighting purposes increased by 6 per cent. on units supplied. The consumption for power purposes increased to an enormous extent. The fact that more electricity should be used for lighting purposes despite the extra hour of daylight as compared with the same period of 1915 is interesting, and it is difficult to account for it unless it is due to an increase in the number of householders using electricity for lighting purposes only.

Morocco.—The plant at the central station in Tangier, of the Compania Trasatlantica, has recently been increased by the addition of a 200-H.P. Sulzer-Diesel engine and a 135-KW. generator.

Perth.—Bonuses.—The Corporation Electricity Committee has granted a war bonus of 2s. per week to the employés at the electricity station.

Southampton.—Proposed Extensions.—The borough electrical engineer has drawn attention to the necessity of preparing a scheme of boiler extensions, and has been authorised to prepare such a scheme. In view of experience as to the heating of stored coal, a drift had been cut through the large heap, which was found to be in good condition. The Council has in stock about four times as much coal as in normal times.

Swansea.—The manager of the Municipal Markets is to confer with the borough electrical engineer as to the fitting up of lights to the stalls at present without lights. The chairman of the Electricity Committee, with the borough officials, is, if necessary, to interview the L.G.B. to obtain sanction to expenditure essential to carry out an extension of plant at the generating station.

Tynemouth.—The electrical engineer has advised that it was not necessary to take any action in regard to linking-up, in view of the existing agreement with the Newcastle Electric Supply Co. with regard to bulk supply. In view of the demands on that company, it has been considered desirable to prepare the Corporation's plant for running.

Walkden.—Electric Pumping Plant. — An electric plant having been installed at Ellesmere Colliery, Walkden, the Roughfield Colliery, a short distance away, which has been used for pumping purposes for over 20 years; is now being dismantled.

Weymouth.—Price Increase.—The T.C. has increased the price of energy from 5d. to 6d. per unit, as from October 1st.

TRAMWAY and RAILWAY NOTES.

Accrington.—Accident.—Last week a collision occurred between a Blackburn car and a single-deck bogie car, causing the service between Accrington and Church to be disorganised for some time, though no one was injured.

Blackpool.—Figures placed before the Tramways Committee show that the receipts are still on the up-grade as compared with last year. For the period from September 15th to October 12th, the receipts were £9,068, an increase of £1,266 over the corresponding period twelve months ago. The aggregate for the year to date was £74,577, against £61,180 last year, an increase of £13,396.

Bolton. — Wages. — The Tramways Committee has declined to accede to an application by the employés for an advance of ½d. per hour in wages.

Bradford.—Wages.—The recent decision of the Bradford Tramways Committee to refer to the Board of Trade, under the Munitions Act, the demand of the tramway employés for advanced wages, which would involve an additional charge of about £21,000 a year to the department, was opposed at last week's meeting of the City Council, and the chairman of the Tramways Committee agreed to the minute being referred back for further consideration. It now transpires that the matter is being left for the new Committee, which will be appointed next month, to deal with.

The tramways Committee, in view of the shortage of labour and other conditions of the time, has recommended that the general manager (Mr. C. J. Spencer) be given liberty to curtail car services as he may think fit.

Edinburgh.—Trolley System Recommended.—The Sub-Committee appointed by the Corporation Tramway Committee to consider the system of traction to be installed on the expiration of the present company's lease in 1919, has reported in favour of the overhead trolley system as the best, most reliable, convenient, and economical solution of the city's transit requirements.

Leeds.—Mineral Traffic.—In connection with recent negotiations between the Tramways Committee and the Leeds Fireclay Co. in respect of a proposal that the tramways should convey material between the company's Cardigan Pit and its works at Wortley, the Tramways Committee last week appointed a Sub-Committee to conclude arrangements with the company for the construction of a light railway and the conveyance of material between the points concerned.

A B. of T. arbitrator, to whom was referred the question of wages and war bonus for tramway workers—particularly the women conductors—has decided against the application of the women to be placed on the same sliding scale of wages as the men, the Council's decision here being upheld; but in regard to war bonus, which the Council refused to the women, the women are awarded half of the 3s. per week now paid to men, so far as concerns women of three months' service, and the full bonus for women with 12 months' service. The payments are to be retrospective from the time of qualification. The Corporation's refusal was based on the standpoint that the women were temporary employés.

Rochdale.—Wind Screens.—The Tramways Committee has decided, after consideration, to take no action at present in the matter of fixing screens on the cars for the protection of the drivers in bad weather. The Committee has, however, expressed its willingness, as an experiment, to have, later on, screens fixed to one or two cars on the Bacup section.

Swansea.—The agreement has been completed between the Tramway Co. and the Corporation relative to the supply of electrical energy by the Corporation to the tramways worked by the company. The Electrical Committee states, in regard to linking-up, that by the arrangement with the Tramway Co. it has already done much in this direction, and is endeavouring to make similar arrangements with other large independent customers.

TELEGRAPH and TELEPHONE NOTES.

Blackburn.—The change from the manual to the automatic telephone system was accomplished at Blackburn last week in the quick time of 70 seconds. There is now inter-area exchange with Accrington, and this is the first instance of two towns being thus put into automatic telephonic communication.

Mauritius.—The telegraph money-order service will be extended to Mauritius on November 1st.

Russia.—Negotiations are reported to be in progress between the Russian Post and Telegraph Department and the Swedish-Danish-Russian Telephone Co. with regard to the purchase by the State of the telephone exchanges in the Moscow district, the concession for which will shortly expire and is not to be renewed.

The King's "Our Day" Message.—In connection with "Our Day" (October 19th) the Eastern Telegraph Co. circulated the King's message from the Red Cross headquarters free of all cost to every place where the "Eastern" flies its flag. The Western Union and Commercial Union Cable Companies acted in a similar spirit in connection with the circulation of the message to the Dominions, Colonies, and dependencies served by their lines.—*Financial Times.*

The Telegraph and A.C. Traction.—In the *Annales des Postes, Télégraphes et Téléphones*, M. Marius Latour describes the system which he proposed in 1912 for overcoming the disturbances produced in telegraph lines in the neighbourhood of A.C. railways, and which has been installed on the system of the Compagnie du Chemin de Fer du Midi, with the collaboration of Messrs. Le Boucher and Delpy. The essential features of the syatem are :—Shunting the receiving apparatus, preferably in front of the key, with a resonating circuit capable of side-tracking the disturbing currents, in combination with the insertion in series with the receiver of an impedance of suitable value to increase the effect of the resonating shunt circuit ; putting in series with the telegraphic line a suitable impedance capable of reducing the disturbing currents and permitting the passage without deformation of the signalling currents ; and distributing the latter impedance along the whole length of the line in order to reduce the maximum potential difference between the telegraph line and earth.—*Génie Civil.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

January 8th. Municipal Council Electric Lighting Department. 33,000-volt switchgear. E.L. Department, Town Hall. Specification 10s. 6d.*

Melbourne.—December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

Perth.—November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

South Australia.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

New South Wales.—Time for sending in tenders for 50-ton electric overhead travelling crane for Yarra Street power-house, Newcastle, extended to January 3rd.*

Bradford.—November 11th. Stores for the Tramways Department. Tramway Offices, 7, Hall Ings. Deposit £1 1s. (returnable).

Dublin.—November 2nd. Great Northern Railway Co. (Ireland). Contracts for general stores for 12 months (including several electrical items). See "Official Notices" October 13th.

Glasgow.—October 28th. Corporation. Six months' electrical material for the Cleansing Department. Particulars from Mr. W. Greig, Superintendent, 20, Trongate.

Grenada.—Government. Time for sending in tenders for electric supply at St. George's and suburbs is extended to December 31st. Tenders to Colonial Secretary, Grenada, British West Indies.

Johannesburg.—November 13th. South African Railways Administration. 71,778 tungsten drawn-wire lamps, 19,741 solid-drawn tungsten lamps, and 2,412 carbon-filament lamps.*

November 20th. Corporation. 500 or 1,000 trolley wheels for tramcars (Contract No. 181).*

November 27th. Corporation. 1,000 sets of single-pole, ironclad house-service cut-outs (Contract No. 187).*

Manchester.—October 30th. Low-pressure water and exhaust-steam pipes and supports at Bloom Street generating station. Specifications from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newport.—November 6th. Corporation. Rotary converters and switchgear. See "Official Notices" to-day.

New Zealand.—Dunedin.—January 24th, 1917. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

Walsall.—November 4th. Corporation. Stores for the Tramways Department. Particulars from the Tramway Manager.

Wolverhampton.—October 30th. Wiring installation (400 points), Bushbury, for Messrs. Macfarlane & Robinson, Stafford Street. Returnable deposit of £1 1s.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Glasgow.—The Electricity Committee has empowered Messrs. Train & Taylor to proceed with the construction of the outfall culvert at the new electricity generating station at Dalmarnock, at a cost of £8,500.

Government Contracts.—List of new contracts placed during September, 1916 :—

War Office.

Bridge meggers.—Evershed & Vignoles, Ltd.
Electric cable and wire.—B.I. & Helsby Cables, Ltd. ; Connolly Bros., Ltd. ; W. T. Henley's Telegraph Works Co., Ltd. ; Hooper's Telegraph and India-Rubber Works, Ltd. ; Johnson & Phillips, Ltd. ; St. Helens Cable & Rubber Co., Ltd. ; Siemens Bros. & Co., Ltd.
Electric cells.—J. C. Fuller & Son, Ltd. ; Siemens Bros. & Co., Ltd.
Conduit fittings for electric light plant.—Simplex Conduits, Ltd.
Generating sets.—Austin Motor Co. (1914), Ltd. ; Norris, Henty and Gardners, Ltd.
Switchboard indicators.—Automatic Telephone Co., Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd. ; Dick, Kerr & Co., Ltd. ; "2" Electric Lamp Mfg. Co., Ltd.
Switches.—Sperryn & Co., Ltd.
Tramway track.—W. Jones.
Works services.—Extension of switchboards at Farnborough : General Electric Co., Ltd.

H.M. Office of Works.

Electric wiring, Kew.—Insurance Office : C. Cooper & Co.

Post Office.

Telegraph apparatus.—Gell Telegraphic Appliances Syndicate, Ltd.
Telephone apparatus.—Siemens Bros. & Co., Ltd.
Telegraph pole-arms (tubular).—Bullers, Ltd.
Telephone bells.—British L. M. Ericsson Mfg. Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph cable.—B.I. & Helsby Cables, Ltd. ; Connolly Bros., Ltd. ; Fuller's Wire & Cable Co., Ltd. ; General Electric Co., Ltd. ; W. T. Glover & Co., Ltd. ; Hackbridge Mfg. Co. ; Henley's Telegraph Works Co., Ltd. ; I.R., G.P. & Telegraph Works Co., Ltd. ; Johnson and Phillips, Ltd. ; London Electric Wire Co. & Smiths, Ltd. ; New Gutta-Percha Co., Ltd. ; Siemens Bros. & Co., Ltd. ; Telegraph Construction and Maintenance Co., Ltd. ; Union Cable Co., Ltd. ; Western Electric Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Insulators.—Bullers, Ltd.
Electric lamps and fittings.—General Electric Co., Ltd.
Cable distribution plugs.—B.I. & Helsby Cables, Ltd.
Insulator spindles.—Bullers, Ltd.
Test-hole terminals.—L. Herve.
Bronze wire.—T. Bolton & Sons, Ltd. ; B.I. & Helsby Cables, Ltd. ; Shropshire Iron Co. ; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Copper wire.—Shropshire Iron Co., Ltd. ; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Galvanised-iron wire.—Dorman, Long & Co., Ltd. ; Johnson & Nephew, Ltd.

India Office Store Department.

Accumulators.—Pritchett & Gold, Ltd. ; J. Stone & Co., Ltd.
Bells.—Peel-Conner Telephone Works.
Cells.—General Electric Co., Ltd.
Tape.—Johnson & Phillips.

Salford.—Electricity Committee. A 10-ton overhead travelling crane : Messrs. Herbert Morris, Ltd., £151.

Southampton.—The British Electric Transformer Co., Ltd., wrote to the T.C. stating that the present market prices of 50 and 20-K.V.A. transformers were £64 5s. and £34 10s. respectively. The prices in the contract to supply the Council were £51 5s. and £27 10s. respectively. The company asked that they should be met in the matter. The T.C. resolved that 50 per cent. of the increased cost be paid on future deliveries.

Taunton.—T.C. Russell's new black vein washed beans coal, 2,600 tons, for the electricity works : Cory Bros., Ltd., Cardiff, £1 9s. 2d. per ton, delivered at the works.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, October 27th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Determination of the Saturation Values for Magnetism of Ferromagnetic Metals, Compounds and Alloys, by means of the Kerr Effect," by Mr. S. G. Barker ; "The Influence of the Time Element on the Resistance of a Solid Rectifying Contact," by Mr. D. Owen ; "On Diffusion in Liquids," by Mr. B. W. Clack.

Royal Society of Arts.—Fridays, October 27th, November 3rd and 10th. At 5.15 p.m. At John Street, Adelphi. Chadwick Lectures on "Fatigue and its Effect on Industry and Efficiency," by Professor Stirling.

Association of Supervising Electricians.—Tuesday, October 31st. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Electric Cooking and Heating," by Mr. A. P. Berry.

Liverpool Engineering Society.—Wednesday, November 1st. At 8 p.m. At the Royal Institution, Colquitt Street. Inaugural address by the President.

Chemical Society.—Thursday, November 2nd. At 8 p.m. At Burlington House, Piccadilly. Ordinary scientific meeting.

Greenock Electrical Society.—Thursday, November 2nd. At 7.45 p.m. At 22, West Stewart Street. Ordinary meeting.

Saturday, November 4th. Visit to Glasgow Corporation Dalmarnock electricity station.

Institution of Mechanical Engineers.—Friday, November 3rd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. The Thomas Hawksley Lecture on "The Gas Engineer of the Last Century," by Mr. H. E. Jones.

NOTES.

Export Prohibitions.—A supplement to the *Board of Trade Journal* of October 26th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported to various destinations from the Straits Settlements, Hong-Kong, Nigeria, Gold Coast, Jamaica, Barbados, Trinidad and Tobago, and British Guiana.

Inquiries.—The makers of the "Veriott" electric fire are asked for.

Flash-lamps in the U.S.A.—A note in the *Electrical World* states that the trade in flash-lamps has grown to a tremendous total, greater than ever before. Much of this has been for foreign consumption, although there has been an extraordinary demand from the domestic markets. A considerable part of the export business was to supply the soldiers in the trenches in Europe with lamps, and also for distribution in the British Isles. The air-raid defence regulations curtailed electric lighting to such an extent that there has developed a flourishing demand in England for flash-lamps.

The sale of flash-lamps in the United States has been large for more than one reason. Almost every hardware shop, electrical dealer's store, drygoods store, drug store and many others handle and push flashl-amps. The secret is undoubtedly a regular list price, which is well lived up to, and an enormous discount. The profit is in the neighbourhood of 100 per cent. Also, the manufacturer now stands behind his goods, and if a battery proves defective the customer gets from the dealer a new one without cost, and the dealer in turn obtains one free from the manufacturer.

Raw materials are hard to obtain, and for that reason production has been curtailed to some extent. The cases are for the most part made of brass with a nickel finish, and these materials being in the war order class are about the most difficult of the raw products to obtain. Fibre is also used to a considerable extent for cases, and this, too, is 'way behind on delivery. Considering this condition in manufacturing materials, and also considering the labour situation that has prevailed and the volume of business that has developed, deliveries are excellent.

With one or two exceptions, producers have not as yet raised their prices to the domestic consumer in spite of the heavy increase in cost of materials. It is their aim to try to keep prices down by increasing the volume of output. For the export trade, however, it is understood that there have been advances in price. The 1916 output of batteries for flash-lamps have been conservatively estimated at 130,000,000, of which it is estimated 100,000,000 will be taken by the domestic trade and 30,000,000 by the export trade. Since the majority of these batteries are for renewal purposes, these figures give no indication of the number of flash-lamps that will be turned out this year.

There is always a large demand for this class of goods at Christmas time. Should the demand this Christmas come up to expectations, it is estimated that the supply of batteries will amount to not more than 75 per cent., and of cases to not more than 60 per cent. of the demand. For that reason, manufacturers urge the trade to place their orders early, so as to be sure of a sufficient supply.

B.E.A.M.A. Notes.—Restriction of Imports of Insulating Materials.—The B.E.A.M.A. announces that the Department of Import Restrictions (Board of Trade) has granted to the Association a special licence to import insulating materials in certain classes which are included in the list of prohibited imports. Electrical manufacturers, whether members of the Association or not, can avail themselves of this licence by making application to the secretary of the Association. The Department of Import Restrictions desires it to be known that the granting of a licence is a temporary measure to meet present urgent needs. This licence extends to January 16th, 1917, at which time the necessities of the situation will be again reviewed. It is expected that firms in the meantime will make every effort to obtain in this country the supplies of insulating materials which they require.

New Members.—The B.E.A.M.A. announces that the following firms have been elected Members of the Association :—

Ashton Frost & Co., Ltd., Blackburn.
Bever Dorling & Co., Ltd., Bradford.
Buckley & Taylor, Ltd., Oldham.
Clayton, Goodfellow & Co., Ltd., Blackburn.
Davy Bros., Ltd., Sheffield.
Fullerton, Hodgart & Barclay, Ltd., Paisley.
Galloways, Ltd., Manchester.
Glenfield & Kennedy, Ltd., Kilmarnock.
Lilleshall Co., Ltd., Salop.
Marsdens' Engines, Ltd., Heckmondwike.
Newton, Bean & Mitchell, Bradford.
Pollit & Wigzell, Ltd., Sowerby Bridge.
Robey & Co., Ltd., Lincoln.
Scott & Hodgson, Ltd., Manchester.
S. S. Stott & Co., Haslingden.
Simplex Conduits, Ltd., Birmingham.
Tyer & Co., Ltd., London.
Woodhouse & Mitchell, Ltd., Brighouse.
Yates & Thom, Ltd., Blackburn.

Excess Profits Duty.—Concessions to the Electrical Trade.—The Board of Referees have issued the following Order, dated October 18th, under the Finance (No. 2) Act of 1915, Part III. Excess Profits Duty (Section 42 (1)) :—

"The British Electrical and Allied Manufacturers' Association having made application under the Act to the Commissioners of Inland Revenue for an increase of the statutory percentage as respects the trade or business, or classes of trade or business, hereinafter defined, that is to say, the business of manufacturing in the United Kingdom all or any of the following complete machines and/or apparatus used in the generation and/or application of electric power, viz. :—

"1. Electrical generators of current for commercial purposes.
"2. Electrical motors for the same.
"3. Electrical switches or controllers for electric lighting or power.
"4. Electrical arc lamps and/or incandescent lamps.
"5. Electrical cooking stoves and/or radiators.
"6. Electrical meters for measuring or indicating electricity for light or power.
"7. Electrical transformers for lighting or power purposes.
"8. Electrical lampholders.

"And the Commissioners of Inland Revenue having referred the case to the Board of Referees appointed for the purpose of Part III of this Act by the Treasury, and the Board having heard the applicants and the Commissioners of Inland Revenue by their duly-appointed representatives upon the merits of the said application, and having dealt with the case :

"The Board doth Order that as from the commencement of this Act the statutory percentage as respects the trade or business or classes of trade or business hereinbefore defined shall be increased to 7 per cent. in the case of a trade or business carried on or owned by a company or other body corporate, and to 8 per cent. in the case of any other trade or business."

This means an all-round advantage of 1 per cent. to the electrical industrial concerns to which the decision relates, and in the aggregate it must amount to a substantial sum. We congratulate the B.E.A.M.A. officials who have been responsible for handling the matter upon the success of the negotiations. The increase is an acceptable recognition of the essential national service that is being rendered by the electrical industry.

Appointments Vacant.—Assistant electrician for Sleaford electricity works; fitter-driver (55) for suction gas plant for the Sheffield Corporation Waterworks. See our advertisement pages for particulars.

Accident.—A correspondent states that Francis McDonald, an engine driver at the Aberdeen electricity works, was seriously injured on Saturday by being caught by a revolving shaft.

Wireless Men Wanted.—Electricians and instrument repairers are wanted for the Wireless Section, R.E. A notice regarding the matter appears in our advertisement pages to-day.

Empire Industrial Policy.—The Prime Minister of New Zealand, the Right Hon. W. F. Massey, has promised to speak at a luncheon of the British Empire Producers' Organisation at the Waldorf Hotel on Tuesday next, when Sir Henry Birchenough, K.C.M.G., will preside. The guests will also be addressed by Mr. F. R Davenport, chairman of the British Electrical and Allied Manufacturers' Association. We are informed that it is the aim of the British Empire Producers' Organisation to co-ordinate the efforts of sectional trade associations and further the gradual formation of a practical Imperial economic system under which British national resources and manufactures will be developed for the benefit of the whole population.

Juvenile Workpeople.—A Memorandum (No. 13) on the subject of juvenile employment, recently issued by the Health of Munition Workers' Committee, contains valuable information on this important matter ; we are glad to note that the necessity of supervising the conditions of living, not only in the factory, but also at home, is insisted on. It is recommended that the hours of labour should not exceed 60 per week, that Sunday labour and night work should be avoided, and that the periods of continuous labour should be short. The importance of "Welfare Supervision" in the case of boys and girls is particularly emphasised, and detailed instructions have been issued by the Ministry for the guidance of supervisors. Not the least serious subject is the demoralising effect that may be produced by the high wages now commonly earned by young boys and girls, and the urgent importance of encouraging thrift is pointed out. The Memorandum is of immediate interest to all employers of juvenile labour.

Cutting Cable Trenches by Power.—A recent issue of the *Electrical World* mentions that the Utah Power and Light Co., Salt Lake City, is employing a pneumatic jack hammer, operated from a portable air compressor, for cutting trenches in pavements to lay electric cables. Based on 670 ft. of 4-in. trench cut in concrete 4 in. thick, the energy consumption was 182 kw.-hour per lineal ft. of trench. The same equipment has been used on railroad work for cutting a 6-in. by 10-in. trench in concrete for relaying tracks, and it was estimated that the labour of 10 men was eliminated.

Educational.—Last week the Association of Technical Institutions passed a resolution instructing the Council to consider and issue a statement to the nation dealing with the immediate necessity of the further development of technical education, subject to the statement receiving the approval of the Association. A further resolution was carried calling upon the Government to prevent any child leaving school before the age of 14, and to compel employers to allow their employés to attend continuation day classes up to the age of 17, for six hours per week.

American Electrical Range Production.—The *Electrical World*, in reviewing the question of electric cooking range production in 1916, which it had been expected would be valued at a million dollars, based on manufacturers' selling prices, now considers that it will exceed two million dollars in value. Prices are tending to increase owing to the increased price of metals and insulating material ; resistance wire is difficult to obtain, due, it is said, to difficulty of obtaining suitable diamond dies for drawing the wire. It is remarked as strange, in view of central station clamourings for cheaper ranges, that the greatest demand appears to be for stores retailing at about $100, and this it is considered argues well for the permanency of electric cooking, and few people would care to scrap a $100 equipment.

Legal Matters.—The Privy Council, on October 23rd, gave judgment in the case of the Toronto Electric Light Co., Ltd., *v.* the Corporation of the City of Toronto, which was argued before the Long Vacation. The appeal of the company was dismissed.

At the City of London Quarter Sessions there is now being heard an appeal by the Metropolitan Railway Co. against certain quinquennial assessments of their properties in Kensington, Paddington, and the Holborn Union. Our reports of these matters are held over owing to pressure upon our space this week.

Institution and Lecture Notes.—Greenock Electrical Society.—The following is the programme for the session, which opened on Thursday last week with a paper, by Mr. A. Norwell, on "Steam Turbines"—

November 2nd, Thursday.—Open night for discussion.
November 4th, Saturday.—Visit to Glasgow Corporation, Dalmarnock, electricity station.
November 16th, Thursday.—"A Criticism of the I.E.E. Rules," by H. Piggott.
November 23rd, Thursday—Visit to Overton Paper Mills.
November 30th, Thursday.—"What is Electricity?" by J. L. Hogg.
December 5th, Tuesday.—Visit to J. Drummond & Sons.
December 14th, Thursday.—"The Art of Wiring," by J. Nichol.
December 21st, Thursday.—Open night—papers by junior members.
January 11th, Thursday.—"Factory Installations," by R. T. Paterson.
January 25th, Thursday—Open night for discussion.
February 8th, Thursday.—"H.T. Conduit Systems," by H. J. Roberts.
February 17th, Saturday.—Visit to Dellingburn power station
February 22nd, Thursday.—"Electricity Supply Costs," by F. H. Whysall.
March 8th, Thursday.—"Notes on the High-Speed Engine," by S. V. Thorp.
March 22nd, Thursday.—"Electric Welding," by Duncan Angus.
March 24th, Saturday.—Visit to Gateshide Colliery, Cambuslang.

Liverpool Engineering Society.—The new session opens at the Royal Institution, Colquitt Street, Liverpool, on Wednesday next, November 1st, with the presidential address of Mr. T. M. Newell. The programme for following meetings is as under;—

November 15th.—James Glover, "The Civil Engineering Profession and some Economic Problems."
November 29th.—T. L. Norfolk, "Notes on the Construction of Modern Dock Gates."
December 13th.—H. Shephard, "Works Costing Systems."
January 9th, 1917.—Arthur Brooker, "Screw-measuring Apparatus."
January 24th.—Tom R. Thomas, "The Education of Apprentices to Engineering and Allied Trades."
February 7th.—W. Hemming Jones and W. A. Oglethorpe, "The Gladstone Dock."
February 21st.—Discussion on above.
March 7th.—Prof. S. W. Perrott, "Some Problems on Railway Curves."
March 21st.—L. Leighton, "Equipment of King George Dock, Hull." (Joint meeting with Manchester Section of the Institution of Electrical Engineers.)
April 4th.—J. Hamilton Gibson, "The Michell Thrust Block and Journal Bearing."

Belfast Association of Engineers.—This Association held its opening meeting for the session in the Municipal Technical Institute, Belfast, on October 19th, when the new president, Mr. Stanley Johnston, delivered an address. Mr. Johnston referred to the fact that during the term of office of the retiring president, Mr J. W. Kempster, D.L., M.I.E.E., the status of the Association had been raised enormously. The subject of Mr. Johnston's address was scientific and industrial research. Mr. Kempster and Mr. W. Pleasance, A.M.I.E.E., have been added to the Committee, and Mr. H. Fildes, A.M.I.E.E., is secretary. The new president is also an electrical engineer. The programme for the session is as under :—

November 16th.—"Cement Manufacture," F. W. Davis.
December 21st.—"Water Power in Ireland," A. W. Brown.
January 18th, 1917.—"Electric Lifts for Land and Shipboard," C. G. Major.
February 15th.—"Liquid Air," Ed. A. S. Swinson.
March 15th.—"An Anticipating Governor for Marine Engines," Andrew Kerr.
April 19th.—"Engineering Notes on a Tour in the Antipodes." J. H. Chambers.

Institution of Civil Engineers.—In addition to the Awards announced in April for papers read at meetings, the Council has made the following Awards for papers published in the *Proceedings* without discussion during the Session 1915-16 :—

Telford Premiums to Messrs. Hubert Mawson (Liverpool), T. W. Keele (Sydney), R. W. Holmes (Wellington, N.Z.), W. Fairley (London), J. M. Greathead (Johannesburg), T. C. Hood (Manmad, India) and J. R. Ball (London).
The Manby Premium to Mr. W. C. Cushing, Pittsburg, U.S.A.
The Crampton Prize to Major C. E. P. Sankey, D.S.O., R.E., London.
The Indian Premium for 1916 has been awarded to Sir John Benton, K.C.I.E., Eastbourne.

Institution of Electrical Engineers.—Western Local Section.—The opening meeting of the session was held on Monday evening at Bristol. Mr. D. Roberts, the retiring chairman, installed his successor, Prof. D. Robertson, who proposed a vote of thanks to Mr. W. Collins, the retiring hon. secretary. Mr. W. A. Chamen and Mr. H. Farraday Proctor warmly supported the resolution, which was cordially accepted. (Mr. C. P. Sparks (president I.E.E.) was present, and gave a brief address on the work of the Institution; he stated, in connection with the scheme for training disabled men, that 40 men had already been trained and placed, and it was hoped to place another 40 by Christmas. Applications had been received for 10 to 15 more, and local Committees were to be formed to extend the scope of the work. The number of members serving with H.M. Forces was 1,550, of whom 71 had lost their lives, and 91 had gained distinction. Prof. D. Robertson then delivered his inaugural address, dealing with industrial problems and the necessity of encouraging scientific training in schools and research in industry. Possible new sources of energy were also discussed.

The British Fire Prevention Committee.—The Committee enters its twentieth winter session this month, and, to mark the event, it has prepared a list of the collection of "Red Books," "Warnings," &c., that have been issued by the Committee since its formation. The list is obtainable upon application to the Committee's Registrar, at 8, Waterloo Place, London, S.W. The Committee's "Red Books" number 204, and of these 35 deal with general subjects, mainly such as fire-resisting construction and notable fires. The quarto *Journals* generally deal with the fire preventive organisations of foreign countries, notably in France, Russia and Italy. No other such collection of publications dealing with fire protection exists in Europe, and complete files of the Committee's reports have been recently obtained by American Government Departments and by the great Universities and technical libraries of the United States.

Future Advances in Lamp Efficiency.—At the tenth annual convention of the Illuminating Engineering Society, at Philadelphia, Dr. Steinmetz read a presidential address on "Present Aspects of and Future Prospects for Lighting Sources," in the course of which he pointed out that comparatively small further progress in lamp efficiency was to be expected from incandescent sources, but that the greatest promise of approaching the theoretically possible light production of 300 to 400 lumens per watt, lay in the direction of the luminous flame arc and of some form of electro-luminescence. Already an efficiency of 100 lumens per watt (about 8 c.p. per watt, or 0·12 watt per candle) had been achieved in the laboratory with high-power luminous arcs on the one hand, and on the other there had been demonstrated the very high efficiency of luminescence in the case of substances like Willemite, as measured from energy input to light output. Any attempt to improve the efficiency of a light source must centre upon the radiating element which transformed the received electrical energy into light. Here, as elsewhere in physics, if the energy transformation proceeded from a high form of energy to a similar form or to a lower form, extremely high efficiency was possible. On the other hand, transformation from a low form, like heat, to a high form, like mechanical energy, must always be attended by inefficiency; while transformation between two energy forms of similar degree, like magnetic energy and electrical energy, took place easily.

Efficiencies approaching the theoretical limit of 300 to 400 lumens per watt were to be expected ultimately from the unexplored field of electro-luminescence. Willemite, for example, under cathode bombardment exhibited a luminescence closely approaching the firefly's light, showing a broad band entirely in the visible range of the spectrum. Here, in this electro-luminescence, the physicist had an energy conversion of the highest efficiency, as measured from input to output, but some efficient method of applying the exciting energy to the luminescent body remained to be discovered. It was, however, in these luminescence phenomena, as well as in the direction of the luminous arc—rather than in incandescent sources, said Dr. Steinmetz—that future radical advances in efficiency might be expected.—*Electrical World.*

The Shares of Siemens Bros.—According to the newspaper Press, Mr. Pretyman says he is considering, in consultation with expert advisers, the British firms, or classes of firms, to whom it is desirable, in the interests of the electrical industry of the country, that the shares of Siemens Bros. & Co. should be sold. He hopes this will shortly be decided, and the Public Trustee will then be in a position to deal with the shares which have been vested in him.

Volunteer Notes.—First London Engineer Volunteers.—Headquarters, Chester House, Eccleston Place, S.W. Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, October 30th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8.

Tuesday, October 31st.—School of Arms, 6—7. Lecture, 7.15, "The Duties of the N.C.O." by Company Commander Hynam. Range Practice.

Wednesday, November 1st.—Instructional Class, 6.15. Platoon Drill, Platoon No. 1. Range Practice.

Thursday, November 2nd.—Platoon Drill, Platoons Nos. 5 and 6. Range Practice. Lecture by Medical Officer, 6, "Marching and the Care of the Feet."

Friday, November 3rd.—Technical for Platoon No. 10. Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, November 4th. N.C.O.'s Class, 2.30, Company Commander Fleming.

Sunday, November 5th.—Entrenching at Otford.—Parade Victoria (S.E. & C. Railway Booking-office), 8.45 a.m. Uniform, haversacks, water bottles. Mid-day ration to be carried. Railway vouchers will be provided.

(By order) Macleod Yearsley, *Adjutant.*

October 28th, 1916.

3rd (Old Boys' Corps) Batt. County of London Volunteer Regiment.—Battalion Orders by Major R. J. C. Eastwood (Commandant), Thursday, October 26th, 1916 :—

Week-end Parades.—Saturday. The Battalion will parade at Liverpool Street Station, at 8.40 a.m., for Entrenching Duties, or at 1.20 p.m.

Sunday.—The Battalion will parade at Liverpool Street Station at 9.30 a.m., for Entrenching Duties.

Battalion Parade. The Battalion will parade at the London Scottish Drill Hall, Buckingham Gate, S.W., on Thursday, 26th inst., at 7.30 p.m., for drill under the Commandant. Order: Mufti, without arms.

Recruits will parade at Lord's Cricket Ground on Saturday, 28th inst., at 2.45 p.m., and on Sunday, at 11 a.m. and 2.30 p.m., for Recruit Drill.

G. H. F. Duncan, *Adjutant.*

An Interrupter Interrupted.—The Niagara and Erie Power Co. has obtained an injunction restraining the Seneca Iron and Steel Co. from employing a device to interrupt the electric supply, and thus, by avoiding the provisions of an agreement, to obtain energy at a minimum rate. Under the agreement the Steel Co. was to pay for the average of the highest daily one-minute peaks occurring during the month; greater demands lasting less than a minute were not to be considered. The company, however, installed a device to interrupt the circuit every 50 seconds, so that no peak of one minute's duration occurred, and this the Court has decided against.—*Electrical World.*

Metropolitan Association of Electric Tramways Managers.—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall Court, Whitehall, S.W., on Friday last, when there were present:—Messrs. Ullmann (East Ham), Schofield (Leyton), Harvey (Ilford), Williams (Erith), Hammond (Met. Elect.), Mackinnon (L.U.T.), Mason (South Met)., Slattery (West Ham), and Goodyer (Croydon). Mr. Ullmann was re-elected chairman, Mr. W. E. Hammond was elected vice-chairman, and Mr. T. B. Goodyer was re-elected hon. secretary. Letters of inability to attend were received from Mr. Bruce (L.C.C.), Mr. Murray (Walthamstow), and Mr. Stokes (Bexley). Various matters of interest were discussed.

Grant to a Tram-Car Driver.—The Leeds Tramway Committee has made a grant of £5 to Sam Clayton, in recognition of meritorious conduct whilst driving a runaway car in Beeston Hill.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. C. T. ASTBURY has relinquished the post of resident electrical engineer to Atherton U.D.C., having been appointed burgh electrical engineer at Wishaw, in place of Mr. S. Williams, who has resigned on taking up a position in the Navy. Mr. Astbury has been at Atherton 11 years.

General.—Lance-Corporal H. PERKINS, who previous to the outbreak of war represented Messrs. Falk, Stadelmann & Co., Ltd., electrical department, on the East Coast and the Midlands, and joined the Royal Engineers as a motor dispatch rider, has been made a full corporal.

Mr. D. G. E. BARRIE has relinquished his connection with Messrs. Hogan & Wardrop, and has taken up an appointment with the Enterprise Manufacturing Co., of Gun Street Electrical Works, Bishopsgate, E.C.

A notice of interest to "John Taylor (an electrician)" will be found in our advertisement pages to-day.

London Gazette Notices.—Territorial Force. Royal Garrison Artillery. London Electrical Engineers: Second-Lieutenant (temporary Lieutenant) R. H. SMITH, O.T.C., Unattached List, T.F., to be Second-Lieutenant. Tyne Electrical Engineers: H. S. WATSON to be Second-Lieutenant (on probation); E. R. BRIGHAM to be Second-Lieutenant (on probation).

We regret to learn that Mr. A. C. SWALES, who has been Secretary of the Junior Institution of Engineers since 1911, has retired from that position owing to ill-health.

Col. Sir H. C. L. HOLDEN, Director of Mechanical Transport, has been elected the Upper Warden of the City Guild of Gunmakers.

Roll of Honour.—Private JOHN FENNELL, who has been killed in action, and Private CHARLES WHITLES, who has been wounded for the second time, and is in a London hospital, were employés of the Keighley Corporation electricity works.

Private J. P. KACKLIN, York and Lancaster Regiment, reported killed in action, aged 36, was employed in the Hull Corporation electrical department.

Sapper J. CLARK, R.E., killed in action, aged 27, was an electrical engineer in South Africa.

Gunner H. MASON, R.G.A., who has been awarded the Military Medal for gallantry in the field, was previously employed as an electrician at Messrs. Rowntree's, at York.

Private J. ATHERTON, Lancashire Fusiliers, has won the D.C.M. It is stated that when the telephone wire was cut, and, owing to smoke from bursting shells, visual signalling was impossible, he went out and repaired the broken wire in two places.

Second Lieutenant (Temporary Lieutenant) GAINS DAVY, R.E., has been awarded the Military Cross for conspicuous gallantry during operations. He remained for many days at the exchange, and, by his energy, kept up the communications in spite of the wire being frequently cut by shell-fire. One night he remained out relaying and repairing wires under shell fire.

Sergeant ALBERT CLARKSON, Royal Flying Corps, reported missing, was an electrician with Mr. Calverley, of Burnley.

Sergeant REGINALD BALDWIN, who was on the staff of the Tunbridge Wells Corporation electricity department, has been wounded.

The D.C.M. for gallantry in the field has been granted to Corporal F. ROGERS, South Staffordshire Regiment, who was with the Electric Construction Co., Wolverhampton.

Sergeant D. S. GREENHILL, Grenadier Guards, who has died of wounds received in action, was on the Rugby staff of the British Thomson-Houston Co., Ltd.

Corporal L. DAVIES, R.E., who has fallen in action, was engaged in the chemical laboratory of the British Thomson-Houston Co., Ltd., Rugby.

Bombardier ROBERT HENRY SANDERSON, who joined the Cumberland Artillery whilst on the staff of the Carlisle Municipal electricity department, at the outbreak of war, has received from the King of Serbia a gold medal for services rendered in Gallipoli.

Private R. CLARKE, Lincolnshire Regiment, formerly at Stamford with the Urban Electric Supply Co., who has been missing for more than a year, is now officially presumed to be dead.

Lance-Corporal E. C. RYLES, Royal Fusiliers, who has fallen in action, was engaged with Messrs. Bullers, Ltd., of Hanley.

Private W. SHERWIN, Royal Fusiliers, who was with Messrs. Taylor & Tunnicliffe, of Hanley, has been killed in action.

Lieutenant W. H. KEMBER, South Lancashire Regiment, is reported wounded. He was formerly engaged at the British Westinghouse Works.

Private A. COUPLAND, Royal Fusiliers, has been wounded, and is now in the Hurdsfield House Hospital, Macclesfield. He was employed with Messrs Ferranti, Ltd., at their meter testing depôt in Clerkenwell.

Sergeant-Instructor HOPE TRAVIS and Company-Sergeant-Major JOE HOLMES, employés of the Oldham tramways, have been recommended for the D.C.M.

With reference to the death at the Front of Private J. LETTS, reported in this column last week, we are asked to state that this does not refer to Mr. Arthur Letts, who is station superintendent at the Lincoln Corporation electricity works, and is the only person of the same name that has been employed there.

Second-Lieutenant JOHN SEEAR GIBSON, A.M.I.E.E., aged 32 years, has died of wounds.

The following is the Roll of Honour of the St. Marylebone electric supply department down to date. 130 members of the staff have joined H.M. Forces, equal to 45 per cent. of the total male pre-war staff:—

KILLED IN ACTION.

Pte. A. H. Bowen, 24th Co. of London Regt.	Stores Dept.
Pte. C. F. Lewis, 10th Gloucester Regt.	Lamplighter.
Rifleman A. J. Scott, 21st Co. of London Regt.	Cost Office.

DIED ON SERVICE.

Pte. A. P. Grover, 18th Co. of London Regt.	Generating station

PRISONER OF WAR IN GERMANY.

Pte. A. J. Snow, 13th Co. of London Regt.	Sales Dept.

WOUNDED OR BROKEN IN HEALTH.

*Lance-Corporal F. Boyall, 3rd Essex Regt.	Lamplighter.
*Driver W. Curtis, 72nd Brigade R.F.A.	Lamplighter.
*Rifleman A. Gamble, 5th King's Royal Rifles	Generating station.
*Pte. G. Gill, 10th Middlesex Regt.	Sales Dept.
Sergeant W. Gregory, 1st East Surrey Regt.	Lamplighter.
*Rifleman B. C. Hartopp, 18th Co. of London Regt.	Generating station.
*Sergeant T. Hayes, Army Ordnance Corps	Mains Dept.
Pte. W. Higgins, 3rd Middlesex Regt.	Mains Dept.
*Sapper G. Lobb, Royal Engineers (Royal Naval Division)	Sales Dept.
*Driver G. A. Oliver, 26th Brigade R.F.A.	Mains Dept.
Pte. G. Rolf, 3rd Co. of London Regt.	Sales Dept.
Rifleman F. G. Saw, 9th Co. of London Regt.	Sales Dept.
Corporal G. Sell, 21st Co. of London Regt.	Stores Dept.
Rifleman A. W. Turner, 2nd Battalion Rifle Brigade	Mains Dept.

* Since discharged.

Obituary.—MR. WALTER HANCOCK.—The *Times* "Deaths" Column announces that Mr. Walter Hancock, M.I.E.E., died on October 17th, in his 86th year, at his residence, 10, Upper Chadwell Street, Myddelton Square, E.C.

Wills.—The late Mr. GEORGE KEITH, of the Cuba Submarine and Amazon Telegraph Companies and of the Chile Telephone Co., Ltd., left £60,452 gross and £59,726 net personalty.

The late Mr. LESLIE S. ROBERTSON, who with Lord Kitchener was lost in the *Hampshire*, according to the *Times*, left £10,945.

NEW COMPANIES REGISTERED.

Zinc Producers' Association Proprietary, Ltd. (1,528F).—Somerset House particulars of the Australian Company. Particulars of the Zinc Producers' Association Proprietary, Ltd., were filed at Somerset House on October 19th, pursuant to Section 274 of the Companies (Consolidation) Act, 1908. This company was registered in Victoria, Australia, on May 20th, 1916, with a nominal capital of £100,000 in £1 shares (no shares beyond the first £50,000, and no debentures, to be issued without the prior consent of the board). It is a cardinal principle that the company is to be and remain under British control, and accordingly (*a*) no alien can be a director or one of the principal officers of the company, (*b*) no share may be held by or in trust for, or under the control of, any alien or foreign corporation, or any corporation under foreign control, (*c*) no person whose country of origin is now at war with His Majesty the King may hold office in this company or any share or shares therein. "Alien" means any person who is not a British-born subject, or who was not naturalised in a British Possession prior to June 30th, 1905, and "foreign corporation" means any corporation other than a corporation established in some part of His Majesty's Dominions, and having its principal place of business therein. "Corporation under foreign control" includes (*a*) a corporation of which a majority of the directors are aliens, (*b*) a corporation in which such voting power as, in the opinion of the board of this company, may give reasonable control is in the hands of aliens or foreign corporations, or persons who hold directly or indirectly for them, and (*c*) a corporation the executive of which is a foreign-controlled corporation. The number of directors is not to be more than 15. Each of the following companies may nominate one director, viz.:—Broken Hill Associated Smelters Proprietary, Ltd.; Amalgamated Zinc (De Bavay's), Ltd.; Broken Hill South Silver Mining Co.; Broken Hill Proprietary Block 10 Co., Ltd.; Broken Hill Proprietary Block 14 Co., Ltd.; Junction North Broken Hill Mine; Broken Hill Proprietary Co., Ltd.; Mount Lyell Mining & Railway Co., Ltd.; Sulphide Corporation, Ltd.; British Broken Hill Proprietary Co., Ltd.; Zinc Corporation, Ltd. The Burmah Corporation, Ltd., is also mentioned as having power to nominate a director if it become a member of the company. There is to be a London Board, an advisory member of which may be appointed by the Imperial Government. The directors at October 18th, 1916, were: W. L. Baillieu, W. M. Hyndman, M. Cohen, G. A. Grant, A. Campbell, B. Kelty, and J. L. Wharton, all of Melbourne; F. C. Howard and B. A. Moulden, both of Adelaide; D. E. McBryde, North Road, Brighton; F. A. Govett, 30, Copthall Avenue, E.C.; F. A. Keating, 22, Bishopsgate, E.C.; and W. H. Woodhead, Hyes, Rudgwick, Sussex. The British address is at Pinner's Hall, Austin Friars, E.C., where W. S. Robinson is authorised to accept service of process and notices on behalf of the company.

Universal Electric Supply Co., Ltd. (145,102).—This company was registered on October 17th, with a capital of £3,000 in £1 shares (600 6 per cent. cum. pref.), to take over the business of a dealer in electrical novelties carried on by J. H. Ward, M. H. Goldstone, A. A. Goldstone, and L. B. Goldstone, carried on at 87, Great Ducie Street, Manchester, as the Universal Electric Supply Co. The subscribers (with one share each) are: A. Hitner, 7, Linden Grove, Fallowfield, Manchester, provision merchant; T. Milligan, 4, Ambush Street, Higher Openshaw, Manchester, book-keeper. Private company. The number of directors is not to be less than two or more than five; the first are A. Lowe and T. Milligan (both permanent), and A. Hitner (general manager). Solicitor: G. P. Haworth, 19, Chapel Walks, Manchester. Secretary: A. Hitner. Registered office: 19, Chapel Walks, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Manaos Tramways & Light Co., Ltd. (101,081).—Capital, £300,000 in £1 shares. Return dated September 15th, 1916. All shares taken up; £100 paid; £299,900 considered as paid. Mortgages and charges, £291,000.

Llangollen and District Electric Light & Power Co., Ltd. (75,384).—Capital, £6,000 in £1 shares (2,500 pref.). Return dated October 13th, 1916. 2,114 shares taken up; £2,110 15s. paid, leaving £3 5s. in arrears. Mortgages and charges, £2,800.

Birmingham District Power & Traction Co., Ltd.—Conveyance, dated October 2nd, 1916, as collateral security for £30,000 advanced to the Birmingham & Midland Omnibus Co., Ltd., charged on certain freehold premises at Tividale, Staffs. Holders: Halifax Permanent Benefit Building Society, Princess Street, Halifax.

Bullers, Ltd.—Deposit on September 27th, 1916, of deeds of lands, buildings, and hereditaments known as Downfield Side Farm and land forming part of a field known as Horse Moor, both in Norton-in-the-Moors, Staffs., to secure all moneys due or to become due from the company to Barclay & Co., Ltd., 54, Lombard Street, E.C., not exceeding £25,000.

Carville Site & Power Co., Ltd.—Issue on October 14th, 1916, of £10,000 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Companies Struck Off the Register.—The following companies have been struck off the register, and they are accordingly dissolved:—

Atlas Anti-Friction Metal Co.
Domestic Engineering Press.
Eclipse Rail-Track Co.
Electric Ozone Syndicate.
International Asbestos Co.
Traffic Indicators.
United Lighting & Maintenance Co.
Wireless Electric Light Co.

Western Telegraph Co., Ltd.—The directors are transferring £100,000 towards the reduction of the amount of capital expenditure in excess of the share capital and debenture stock issued, £100,000 to the general reserve fund, £30,000 to the land and buildings depreciation fund, £100,000 to the provision on account of investment fluctuations, and they recommend a final dividend of 3s. per share, making the total 6 per cent. for the year ended June, 1916, also the payment of a bonus of 4s. per share, both free of income-tax. The balance is to be carried forward.

Consolidated Diesel Engine Manufacturers, Ltd.—In the Companies' Winding-up Court, on Tuesday, Mr. Justice Neville heard an application by Mr. Ellis, a shareholder, for an order against the liquidator of the above company to pay him a first return of 10d. a share on 4,617 shares. The summons was dismissed.

City of Buenos Aires Tramways Co. (1904), Ltd.—Dividend of 1s. 3d. per share (at the rate of 5 per cent. per annum), less income-tax, for the three months to September 30th.

Trafford Park Estates, Ltd.—For the year ended June last the profit was £30,173. A dividend of 4 per cent. is to be paid, and £50,353 carried forward, as against £45,070 brought in.

Norwich Electric Tramways Co.—Dividend, 3 per cent. (6s. per share) for the year, placing £5,000 to reserve and £1,000 to 1914 Act account, carrying £429 forward.

Kaministiquia Power Co.—Dividend of $1.75 per share (at the rate of 7 per cent. per annum) for the quarter ending October 31st.

J. F. & G. Harris, Ltd.—The net profit during the period ended June, 1916, was £419. The full preference dividend has been paid, and £43 is carried forward.

United Electric Tramways of Caracas, Ltd.—Dividend of 7 per cent. (1s. 4 4/5d. per share), less tax, for the year, carrying £2,428 forward.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th. 15s. per cent. on the ordinary stock and 30s. per cent. on the preferred stock, less income-tax at 5s. in the £.

Marshall, Sons & Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, less tax, for the half-year ended June 30th.

Brazilian Traction, Light & Power Co., Ltd.—Dividend of 1 per cent. on the issued ordinary capital stock.

Babcock & Wilcox, Ltd.—Interim dividend of 6 per cent., free of tax, for the half-year ended June 30th.

Hurst, Nelson & Co., Ltd.—According to the "Times," the gross profit for the past year has been £73,426, against £61,819. It is proposed to place to general reserve account £25,000, against £15,000, to pay a dividend on the ordinary share capital at the rate of 10 per cent., free of tax, also a bonus at the rate of 2½ per cent. free of tax. There is to be carried forward, subject to payment of excess profits duty, £14,989. For the preceding year the distribution was 10 per cent.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets continue to show a good deal of irregularity, but business is returning to some of the markets from which it was diverted by the issue of the 6 per cent. Exchequer Bonds and the French National Loan. The principal factor is Roumania, and the character of the news received from Bucharest helps to govern the prevailing sentiment from day to day. There is a certain amount of disappointment in the City at the way in which matters have developed in the land of our latest ally, but the increasing pressure of the British and French on the Somme must obviously have its effect in the number of troops which the enemy is able to employ against Roumania, and, after all, the ultimate end to the war is perfectly patent to everyone.

Were the news from Roumania to take a favourable turn—as, of course, it is likely to do at any moment—there would probably be a quick resumption of the buying movement which lifted prices so substantially last month. Meanwhile, the markets as a whole are walking warily, with prices inclining somewhat to the duller side.

The prior-charge stocks of the Home Railway companies are still very depressed. Holders seem anxious to exchange them for one or other of the Government forms of borrowing, with the result that there has been a further shrinkage in debenture, preference, and guaranteed stocks during the past few days. Some of the ordinary stocks, on the other hand, have rallied. The weakness which was so pronounced in the case of low-priced issues, such as Metropolitans and Districts, is less acute. The speculative buyer, however, is not keen on Home Rails at present. Central London assented ordinary is 2 lower. The Underground Electric Railways of London group is steady. Business in the market as a whole remains anything but brisk. District 4 per cent. debenture at 71½ is 3 points down, and the Sixes at 106¼ are 2 lower. Metropolitan 3½ per cent. preference has dwindled to 60.

Electric lighting shares tend to shrink from their recent prices. County of London ordinary have weakened ¼; there are falls of ¼ in City Lights and St. James's, and of 1/16 in Westminsters. The market has hardly started to discuss dividend estimates in respect of the current six months, but it is safe to assume that the declarations will reflect still further the increased cost of coal and the more stringent lighting regulations. On the other hand, the electric supply concerns which number amongst their customers large users of power will probably be able to give a good account of themselves.

The West-End undertakings are likely to be badly hit by the various restrictions, although in their cases they have the increased consumption by Government offices by way of partial compensation. The order to close shops at seven o'clock, which comes into force next week, can hardly have a favourable effect upon lighting profits. Rumour in the City went one better, and declared that it was the official intention to enforce the closing of all offices at five o'clock during the winter; the sex of the originator of this rumour is not known.

Brazilian Tractions have once more become an active spot, the price fluctuating considerably between the limits of 59 and 55, the latter being the price this, Tuesday, night. The apprehensions as to a possible reduction in the dividend are laid to rest for the time being, and currency has been given to the idea that Brazil may be able to resume cash payments of interest on her bonds—at all events, to some extent—when the moratorium expires in July next. This had a strengthening effect upon most of the securities connected with Brazil, but, apparently, after the first blush of strength had worn off, profit-takers who had bought Brazil Tractions cheaply, hastened to take advantage of the rise, and the price reacted abruptly.

Nothing fresh of note has occurred in Mexico, but prices of the utility companies are flat, all the same. Stocks in the various railway companies—which are taken as an index of the Mexican position—have given way a little. The Argentine group also continues dullish, though evidences are becoming stronger that the Republic has at last got over the consequences of the shock produced by the outbreak of war, and is regaining its former sound financial position. Canadian-American utilities are, on the whole, rather better, the movements, however, being narrow. The fall in British Columbia Electric Railway stocks has made further progress; the 4½ per cent. debenture stock shed 2½ points.

Marconis have come into prominence as the most lively share in the industrial market. From 2¾, the price of the ordinary rose to 3 1/16; and although the fraction was lost later, the market continues to show a good deal of strength. There are vague rumours that the amount of compensation to be paid to the company by the Government is being settled, but in reliable quarters this is considered as being

at any rate unlikely. With the price of the parent shares, Americans have recovered to 18s., and Canadian Marconis are once more close to half-a-sovereign.

The Telegraph market further receded, but during the last few business days buyers have come in. Eastern Extensions fell to 13½, and at 13⅝ they still show ¼ decline. Anglo-American Telegraph deferred dropped another point. The remainder of the group is noticeably steady. Telegraph Constructions are £1 down, and the yield on the shares has therefore risen to 6 guineas per cent. Allowing for the fact that the dividend is paid free of tax, the return on the money is equivalent to over 8 per cent., with a 5s. tax deducted.

The shares in other manufacturing companies are fairly firm. British Insulated preference at 5¼ are 10s. lower. Babcocks are steady at 3. A few of the British tramway shares are easier. London & Suburban Traction preference, for instance, eased off to 8s., and Yorkshire West Riding preference at 4¾ are about 2s. 6d. lower.

The armament group is inclined to waver a little, and the rubber share market has been sharply upset by the announcement that the excess profits tax will be applied rather more stringently than the market had expected. Probably this would not have had much effect had it not been for the general atmosphere of dullness round the Stock Exchange engendered by the news from the Near East. Prices, however, have given way sharply, and with this reaction business contracted to a considerable extent. It is possible that some people bought themselves rather more rubber shares than they could afford comfortably to carry, with the result that this stock—or, at any rate, some of it—is being marketed under conditions anything but favourable to the sellers.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Oct. 21, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6⅝	—	£7 11 0
Charing Cross Ordinary	5	5	3 5/16	—	7 1 4
do. do. do. 4½ Pref.	4½	4½	3 7/16	-	6 6 4
Chelsea	5	4	3	—	6 18 4
City of London	9	8	19½	- ¼	6 12 0
do. do. 6 per cent. Pref.	6	6	10½	- ¼	5 17 1
County of London	7	7	10½	- ¼	6 10 8
do. 6 per cent. Pref.	6	6	10½	- -	5 17 1
Kensington Ordinary	9	7	5⅝	- -	6 4 5
London Electric	4	3	1⅜	- -	6 10 5
do. do. 6 per cent. Pref.	6	6	4 3/16	- -	6 11 4
Metropolitan	3½	3	2⅝	- -	5 14 8
do. 4½ per cent. Pref.	4½	4½	3½	- -	7 4 0
St. James' and Pall Mall	10	8	6¼	- ⅛	6 8 0
South London	5	5	3 1/16	- -	6 16 1
South Metropolitan Pref.	7	7	1 3/16	- -	5 7 8
Westminster Ordinary	9	7	6 1/16	- 1/16	5 13 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98	- 1	6 2 5
do. Def.	30/-	33/6	2 1/4	—	7 10 3
Chile Telephone	8	8	7	—	5 14 5
Cuba Sub. Ord.	5	5	8 3/4 xd	—	6 8 6
Eastern Extension	7	8	13⅝	- ⅛	*5 17 6
Eastern Tel. Ord.	7	8	14 1/2	—	*5 13 1
Globe Tel. and T. Ord.	6	7	12⅜	—	*5 12 0
do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	22	22	40	—	5 10 0
Indo-European	13	13	51	+	6 1 8
Marconi	10	10	3	+ ¼	3 6 8
New York Tel. 4½	4½	4½	100	—	4 10 0
Oriental Telephone Ord.	10	10	2 5/8 xd	+	4 6 6
United R. Plate Tel.	8	8	6 1/8	+ 1/16	*5 17 5
West India and Pan.	1	—	1	—	—
Western Telegraph	7	8	14½	—	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	£8	— 2	5 17 8
Metropolitan	1½	1	29⅜	— ¼	4 8 0
do. District	Nil	Nil	1 1/8	— ⅛	Nil
Underground Electric Ordinary	Nil	Nil	1 1/16	—	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	6	6	89	—	*6 14 7
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4 1/16	—	6 1 6
Anglo-Arg. Trams, First Pref.	5½	5½	8⅛	—	8 9 2
do. 2nd Pref.	5½	5½	2½	—	—
do. 5 Deb.	5	5	70	- 2	7 2 10
Brazil Tractions	4	4	55	- 3	7 5 4
Bombay Electric Pref.	6	6	10½	—	5 17 3
British Columbia Elec. Rly. Pfce.	5	5	7½	—	6 13 0
do. do. Preferred	—	Nil	56	- 1	Nil
do. do. Deferred	—	Nil	55	- 1	Nil
do. do. Deb.	4½	4½	66½	2½	6 7 12
Mexico Trams 5 per cent. Bonds	—	Nil	40	- 3	Nil
do. 6 per cent. Bonds	—	Nil	28½	- 1½	Nil
Mexican Light Common	Nil	Nil	17	- 1	Nil
do. Pref.	Nil	Nil	21	2	Nil
do. 1st Bonds	Nil	Nil	40	- 1	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	3	—	5 0 0
British Aluminium Ord.	5	7	28/3	—	5 11 4
British Insulated Ord.	15	17½	12½	—	7 0 0
British Westinghouse Pref.	7½	7½	2½	—	6 0 0
Callenders	15	20	12½	—	8 0 0
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	8⅝	—	5 6 8
Edison & Swan, £3 paid	Nil	—	10/-	—	Nil
do. do. fully paid	Nil	—	1½	—	Nil
do. do. 4 per cent. Deb.	5	5	62½	—	8 0 0
Electric Construction	6	7½	1 5/16	—	8 0 0
Gen. Elec. Pref.	6	6	10	—	6 0 0
do. Ord.	10	10	14½	—	6 18 0
Henley	20	25	16½	—	7 13 10
do. 4½ Pref.	4½	4½	4½	—	5 0 0
India-Rubber	10	10	12	—	*8 3 4
Telegraph Con.	20	20	38	- 1	*6 6 2

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 25th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£54	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£34	..
a Copper Sulphate	,,	£51	£2 inc.
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	12 /-	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	,,	£13	£1 dec.
a ,, Lump	,,	£15 10	£1 inc.
a Soda, Chlorate	per lb.	1/-	..
a ,, Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	1 5/8 to 1/3 3/8	..
c ,, Tubes (solid drawn)	,,	1/4 3/8 to 1/5	1/8d. inc.
c ,, Wire, basis	,,	1/3 3/8 to 1/4	..
c Copper Tubes (solid drawn)	,,	1/7 1/2 to 1/8	..
g ,, Bars (best selected)	per ton	£168	£2 inc.
g ,, Sheet	,,	£168	£2 inc.
g ,, Rod	,,	£168	£2 inc.
d ,, (Electrolytic) Bars	,,	£144	£2 inc.
d ,, ,, Sheets	,,	£162	£2 inc.
d ,, ,, Rods	,,	£153	£2 inc.
d ,, ,, H.C. Wire	per lb.	1/6	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/4	..
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£36	..
g Lead, English Pig	,,	£31 5	..
g Mercury	per bot.	£17 12 6 to £17 15	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/9½	½d. inc.
r Steel, Magnet, in bars	per ton	£95	..
g Tin, Block (English)	,,	£184 to £135	£2 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/10	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Industrial Harmony.—Sir William Lever, Bt., speaking at the Manchester Athenæum on "Harmonising Capital and Labour," said that it must be admitted that, in spite of better conditions of employment and higher wages, the present position occupied by labour was not acceptable to the workers. The workman was no longer a "hand"; Labour to-day was an educated man, and his wants were growing and his outlook was extending. Labour would not be brought to work side by side with and to harmonise with Capital merely by ever higher and higher wages, shorter and shorter hours, combined with better and better welfare conditions. The lesson for the capitalist was that high wages, short hours and good healthy conditions by increasing intelligence and efficiency, increased output and actually reduced costs. And the lesson for Labour was that increased output stimulated consumption and, consequently, demand for production and distributive labour, the fact being that consumers of all classes supplied themselves where they could be best and most economically served. Only by entrance into co-partnership together could Capital and Labour be brought to pull together, and only by co-partnership could they be harmonised.—*Daily Telegraph.*

U.S. Central Stations.—On the basis of the earnings for the first half of the current year, 1916 should be a very prosperous year for the U.S. electric light and power industry. According to a compilation made by the *Electrical World* from reports received from over 60 per cent. of the industry, the earnings from the sale of energy during the first six months of 1916 amounted to $203,500,000, as compared with $176,300,000 for the first half of 1915. The increase was 15·6 per cent. The output for the first half of 1916 increased 24 per cent. over the first half of 1915, being 10,875,000,000 KW.-hrs., as compared with 8,775,000,000 KW.-hrs. for the first half of 1915. Returns for the month of June were particularly good. Throughout the first half of the current year the factor that stood out most prominently was the remarkable growth in the power load. The motor market was swamped with orders, and many of the motors ordered at this time will not come into use until late in the current year; consequently the demand for power will continue to increase considerably for some time to come. The big increase was from new customers, who had formerly been running under their own power. The flood of orders came with such a rush that there was no time to enlarge private plant, and central station service at once became very popular.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1916.

The September returns of electrical exports and imports show a considerable increase in value in comparison with the August totals; the exports, in particular, maintain the relatively high level of the past few months.

The total value of the exports was £573,314, as compared with £553,957 in August, £487,575 in July, and £603,510 in June.

Of the individual sections, cables, machinery, and telephonic materials made a good showing, while business in the miscellaneous sections, such as accessories, fittings, meters, &c., was above the level of the previous month.

The August telegraphic exports were exceptional in amount, which accounts for the considerable reduction shown in the September total. The imports reached a total value of £237,032, a considerable increase on the August total of £183,151, traceable to the increased amount of American material which entered this country during the month. Holland, due to its lamp industry, again occupies the second place in the list of importers into this country, and it is significant that Japan figures for over £10,000 worth of electrical material sold to us. India was our best customer during the month, while our Australasian colonies and the friendly European countries were also good customers—France in particular, but South American business was on a small scale.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	7,407	1,790	67	3,011	...	5,449	13,514	1,051	690	272	86	4,111	37,448
Netherlands, Java and Dutch Indies ...	833	17,314	1,284	...	62	33	5,011	...	93	62	1,980	720	27,392
Belgian Congo	...	...	...	...	...	...	...	...	153	...	8	47	208
France	11,642	786	293	...	661	212	22,072	7,207	165	846	8,787	4,293	56,964
Portugal	340	1,276	82	239	341	...	347	...	132	...	493	451	3,701
Spain, Canary Isles and Spanish N. Africa...	1,486	...	368	145	...	830	16,166	2,488	275	31	653	1,530	23,972
Switzerland, Italy and Austria-Hungary ...	884	...	260	...	...	34	6,178	...	...	...	7,454	134	14,944
Greece, Roumania, Turkey and Bulgaria ...	...	138	...	...	...	34	...	...	...	...	...	...	172
Channel Isles, Gibraltar, Malta and Cyprus...	93	68	...	18	...	32	125	76	...	17	...	11,391	11,820
U.S.A., Philippines and Cuba	372	...	51	...	...	126	3,437	...	...	22	...	50	4,058
Canada and Newfoundland	1,110	...	993	...	597	...	1,934	700	1,519	...	105	...	6,958
British West Indies and British Guiana ...	39	...	26	99	...	...	147	...	185	7	19	74	596
Mexico and Central America	67	97	...	20	...	...	28	...	28	...	...	...	240
Peru and Uruguay	13	...	446	90	...	...	325	167	609	...	...	24	1,674
Chile	510	3,204	248	357	18	867	2,274	325	31	25	12	269	8,140
Brazil	588	582	86	136	...	20	777	1,338	...	149	...	247	3,923
Argentina	1,270	3,270	336	191	16	1,504	1,198	2,854	941	95	798	176	12,649
Colombia, Venezuela, Ecuador and Bolivia...	175	21	10	353	...	240	10	2,640	...	26	15	275	3,765
Egypt, Tunis and Morocco	518	757	3	170	...	71	1,856	217	928	15	3,479	640	8,654
British West Africa	74	1,424	53	55	...	22	3,000	...	...	...	57	141	4,826
Rhodesia, O.R.C. and Transvaal	2,444	2,931	148	950	...	279	1,698	237	646	131	68	5	9,537
Cape of Good Hope	1,405	11,362	492	761	...	3,008	19	...	523	45	7,179	177	24,971
Natal	...	9,782	752	259	...	252	3,554	8,523	21	...	253	226	23,622
Zanzibar, Brit. E. Africa, Mauritius & Aden	386	372	176	280	12	...	37	32	...	...	259	760	2,314
Azores, Madeira and Portuguese Africa ...	409	299	87	87	...	...	530	...	...	5	...	346	1,763
French African Colonies and Madagascar...	224	...	...	...	...	...	36	...	...	...	...	17	277
Persia	1,219	2,226	...	...	...	...	...	...	...	...	...	...	3,445
China and Siam	2,223	6,068	2,251	1,008	12	1,377	4,375	1,965	133	160	20	1,100	20,692
Japan and Korea	91	182	37	98	...	1,070	3,555	...	3,857	...	...	45	8,935
India	4,634	23,190	4,447	1,879	34	1,538	25,871	3,355	4,429	356	4,726	1,234	75,693
Ceylon	406	1,914	231	162	...	120	97	70	213	...	1,336	179	4,728
Straits Settlements, Fed. Malay States and Sarawak	945	1,564	504	524	31	446	2,112	1,621	251	47	1,578	130	9,753
Hong Kong	73	2,488	526	...	...	686	1,516	...	59	...	438	904	6,690
West Australia	189	578	494	28	...	309	715	73	15	...	1,118	...	3,519
South Australia	242	2,681	161	175	...	...	1,824	357	765	29	861	32	7,127
Victoria	2,317	36,459	5,737	604	...	652	10,151	797	746	28	1,987	497	59,975
New South Wales	1,561	20,647	2,101	1,445	...	2,061	6,023	1,135	3,016	186	2,972	805	41,952
Queensland	397	3,591	109	116	...	15	371	933	939	...	1,512	105	8,088
Tasmania	328	700	19	29	...	...	60	...	...	...	...	...	1,136
New Zealand and Fiji Islands	1,094	10,914	2,105	1,062	...	277	2,926	1,568	1,670	21	2,830	2,526	26,993
Total, £	48,008	168,675	24,983	14,351	1,784	21,564	143,869	39,729	23,032	2,575	51,083	33,661	573,314

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	721	...	...	250	1,683	...	14,730	884	1,695	...	867	20,830
Holland...	...	1,020	135	25,737	7,651	...	...	57	654	...	...	35,254
France	160	...	...	251	311	755	200	50	4,838	3,196	2,008	11,769
Switzerland	3,304	...	18	121	...	2,463	7,368	...	96	1,060	102	14,532
Italy	...	2,404	...	...	...	...	...	1,182	...	...	...	3,586
United States	11,383	10,932	5,431	3,031	296	1,452	10,540	68,597	10,669	8,900	6,943	138,174
Japan	2,460	...	3,555	3,090	695	...	...	...	617	...	...	10,417
Total, £	18,028	14,356	9,139	32,480	10,636	4,670	32,838	70,770	18,569	13,156	9,920	234,562

Additional imports.—Spain, carbons, £1,316. Hong-Kong, electrical goods, £114. Canada, glow lamps, £248; electrically-driven machinery, £124; batteries and accumulators, £106; telephone and telegraph appliances, £562.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	1,229	1,376	...	4,062	177	3,870	5,175	...	380	207	2,120	18,596

TOTAL EXPORTS: £573,314 TOTAL RE-EXPORTS: £18,596 TOTAL IMPORTS: £237,032

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned which is not necessarily the country of origin.

FRENCH AND ITALIAN ELECTRICAL INDUSTRY AND THE RUSSIAN MARKET.

In no branch of industry did the Russian market depend so much on importation as in the electrical; and as our readers are aware, with the cessation of the normal importation, the Russian electrotechnical market experienced serious difficulties. The question as to where quickest and cheapest to procure the necessary electrotechnical goods will become still more difficult until the conclusion of peace, owing to the preoccupation of the electrical industry in all countries with war requirements. In many cases, too, the works that are free to cater for the private market are working only for immediate requirements, because of the dearness of raw material, the lack of labour, and other circumstances. Therefore all stocks are completely exhausted, and in order to replenish them, whilst satisfying current requirements, which will grow immensely after the war, great quantities of electrical goods will be required.

In a previous article in the *Elektrichestvo*, last year, from which we quoted very fully, Engineer P. Gurievitch considered to what extent Russian buyers of electrical goods might rely on the English electrical industry for supplies. Using the official statistical data entitled "Tableau Général du Commerce et de Navigation de la France" and the "Movimento Commerciale del Regno d'Italia" for 1913, he now in the same journal dwells on the electrotechnical industry of two other countries allied to Russia—namely, France and Italy—showing their position in the world's markets and their exportation into Russia. The French importation and exportation of electrical goods in 1913 are shown in Table I.

TABLE I.

—	In francs.				Exports to various countries in quintals.						
	Total importation.	Total exportation.	Export to French Colonies.	Export to other countries.	Belgium.	Switzerland.	Sweden and Norway.	Germany.	England.	Russia.	Other Countries.
Electrical apparatus	18,892,000	14,585,000	2,853,000	11,732,000	1,330	283	—	758	336	220	870
Carbons for electricity	1,056,000	8,564,000	33,000	8,531,000	8,695	10,885	13,916	3,389	1,966	—	2,871
Dynamo machines	9,052,000	4,116,000	1,475,000	2,641,000	4,120	439	871	3,005	322	—	2,012
Armatures for electrical machines and parts for electrical apparatus	4,611,000	2,461,000	258,000	2,203,000	1,037	219	—	454	106	—	945
Incandescent lamps	2,622,000	2,230,000	548,000	1,682,000	96	21	—	62	176	—	253
Arc lamps	80,000	248,000	112,000	136,000	17	—	—	13	—	—	72
Conductors and cables	1,017,000	3,421,000	705,000	2,716,000	7,406	452	—	316	567	—	3,849
Porcelain goods for electricity ...	—	612,000	198,000	414,000	207	1,487	—	—	—	—	835
Glass goods	—	450,000	133,000	317,000	—	1,334	—	—	—	—	80
Accumulators	179,000	523,000	162,000	361,000	258	—	—	—	811	497	146

M. Gurievitch says that if we consider the data of the table submitted from the point of view of the possibility of Russia receiving some electrical goods from France in greater quantities than before the war, we must observe that as an exporter of electrical goods France stood far behind Germany, England, and the United States, as can be seen in Table II, which shows the export of electrical products from these countries in 1913:—

TABLE II.

Exporting countries.	Total exportation of electrical goods in francs.	Total exportation of electrical machines, francs.	Per cent. of total.	Total exportation of cables, francs.	Per cent. of total.	Export to Russia, francs.	Per cent. of total export.
Germany ..	407,550,000	79,248,000	24	48,496,000	11·9	42,614,000	10·5
England ..	188,890,000	56,736,000	30	90,165,000	47 0	2,435,000	1·3
United States..	146,340,000	32,680,000	21·7	6,536,000	4·4	(?)	(?)
France	37,210,000	4,116,000	11·1	3,421,000	9·1	(?)	(?)
Switzerland ..	30,162,000	20,353,000	67·5	1,403,000	4·6	3,682,000	12 2
Italy	10,294,000	2,855,000	27·7	7,028,000	68·0	34,000	0·3

Whilst in the case of other countries by far the most important articles exported are either electrical machines or cables, in France the export of these two groups plays only a subordinate part, making only about 10 per cent. of the total exportation. In the French exports the most important position after electrical apparatus is occupied by carbons for electrotechnical work, chiefly electrodes which are sent mostly into Switzerland, Sweden and Norway, where the demand for electrodes for the highly developed electrochemical and electro-metallurgical industries is very great. For Russia, however, with its hitherto feebly-used water power, and the absence of important electrochemical factories, French electrodes cannot serve as an article of importation.

But all the remaining French electrotechnical articles have been exported hitherto only in very limited quantities, so that it is useless to count upon them particularly, the more so as one-sixth of the total French export of electrical manufactures has gone hitherto to the French Colonies, Algiers, Tunis, and Indo-China. The balance of the exports was naturally distributed amongst countries contiguous to France. The principal customer for French electrotechnical goods was Belgium; then Switzerland, particularly the Western French Cantons; then Spain. The exportation of electrical goods into Russia was so insignificant that the French official statistics specified it only in regard to electrical apparatus and accumulators.

The exportation of meters into Russia is, however, specially mentioned; but in the French statistics it is registered in a group including gas and water meters, so that is difficult to say what part is played in this group by electrical meters. The total exportation of meters of all kinds from France made the important sum of 14,087,000 fr. in 1913, whilst the total of meters of all sorts exported into Russia made approximately 790,000 fr.

Thanks to a large export of carbons for electrotechnical work, the French exportation of products of the electrotechnical industry only about equalled the level of the importation of such goods. The French electrical industry therefore has, first of all, to see to it that it can supply the requirements of its own market, before thinking of exporting to Russia.

As to Italy, its electrotechnical industry is still too feebly developed for it to compete on the Russian market with other countries. As an exporter of electrical goods, the Italian industry began operations only five years ago. The first position in the Italian export of these goods, of a total value of 10,294,000 lire, in the year 1913, was taken by electrical conductors and cables, the exportation of which reached 7,028,000 lire, or 68 per cent. of the total export of electrotechnical goods. As, however, was observed by M. Gurievitch in reviewing the English exports, Russia is least of all in want of cables. The second place in the Italian export of these goods is occupied by dynamo machines. Already in the year 1910 the export of these goods was valued at 139,000 lire; in 1911 it rose to 1,265,000 lire; in 1912 to 1,865,000 lire; and in 1913 to 2,046,000 lire. The exportation of heavy dynamo machines, of which the Russian market stands particularly in need, was, on the other hand, particularly small—no more than 205,000 lire. Italy exported transformers to the value of 231,000 lire in 1913, and parts of electrical machines to the value of 373,000 lire. But to Russia she exported only small machines and motors to the value of 32,000 lire. The chief foreign market for the sale of Italian electrotechnical goods was South America (Argentina and Brazil), where Italy sent electrical machines and transformers to the value

of 1,148,000 lire. The export of other electrical goods from Italy was insignificant. Her exportation of electrical apparatus amounted to only 166,000 lire, and of accumulators to 38,000 lire.

Of machines used in the electrotechnical industry, Italy exported in 1913 to the value of 4,758,000 lire, internal combustion motors, including 594,000 lire value for Russia; to the value of 553,000 lire, (of which 41,000 lire for Russia) in steam engines, and to the value of 144,000 lire (of which 15,000 lire for Russia) in water motors.

It is necessary to observe, however, that Italy, to a greater extent even than France, depends on importation for electrical goods, which were valued at 31,955,000 lire in 1913, thus exceeding Italy's export of such goods by three times. With the increase in the development in Italy of hydro-electrical installations, the demand for electrical goods grows there at a great rate, and cannot be satisfied by the Italian electrical engineering shops. Of electrical machines and transformers alone Italy imported in 1913 to the value of 13,501,000 lire, of electrical apparatus, 4,988,000 lire, and of incandescent lamps 9,094,000 lire.

It remains to be said, in conclusion, that French industrial circles, even more than the English, consider the high Russian Customs duties to be an insuperable obstacle to successfully reaching the Russian market. Not hoping by their own strength to struggle with the competition of other countries in Russia, they would like to have a special exemption tariff for themselves that would give them a preference over other countries. Such measures do not find supporters in leading Russian circles, and the Russian Commercial Attaché in Paris, being at the same time the President of the Russo-French Chamber of Commerce, in his reports to the Special French Committee of Economic Inquiry and the Committee for Encouraging Franco-Russian Business Relations, showed more than once that French industry, with goodwill and sufficient energy, may operate on the Russian market on conditions identical with those of other countries. Evidence of this will be found in the powerful invasion of the Russian market by German industry, although it had not an advantage in Customs duties, and certainly no preferences, compared with other countries. All depends principally on the energy of the exporting country and its readiness to meet the Russian buyer by offering him low prices and concessions.

Besides energy and the will to meet the requirements of the buyers, a cardinal part is played in export, however, by the productivity of the exporting industry, and its power to throw on the world's market a great quantity of goods at low prices. In this respect French electrotechnical industry, unfortunately, lags far behind its competitors.

Even for its own market, in France, it is not in a position to supply all the requirements. Whilst a large importation of these goods into England may be explained by the fact that the absence of import duties did not sufficiently protect the English industry from German competition, the important importation into France cannot be so explained, as France, after Russia, is one of the most protectionist countries. It is undoubted, therefore, says M. Gurievitch, that France cannot think of playing an important part in the supply to Russia of electrical goods.

As has, however, been more than once shown in the *Commercial and Industrial Gazette* and in the *Government Gazette*, issued by the Ministry of Finance, with the new trend of Russian trading policy after the war, we must first (says the writer) see to the development of the productive power of Russia; but in the sphere of electrotechnics we must deal with the earliest possible use of the water power of the country, which is an essential factor in view of the chronic scarcity of coal. In the second place, from the financial point of view, we must endeavour to reach a favourable trade balance. The question, however, with whom we shall trade, plays only a subordinate *rôle* of third-class importance, and it should be referred to a back position depending on whether any particular trade is profitable or unprofitable for Russia. The goods of one country may, and should be, exchanged with our own or with the goods of another country, only if such is profitable to the economic progress of Russia. The refusal of any goods only because they are of one or other origin cannot be a healthy principle for a trading policy in time of peace.

THE USE OF COKE-OVEN GAS UNDER BOILERS.

At the present time a great amount of attention is being given to the more efficient utilisation of our national fuel resources, a subject which so far as it affects central station practice, points very strongly to the future use of gas firing for boilers.

Some of the features of present-day practice in this connection were outlined by a coke-oven manager in an article which recently appeared in the *Iron and Coal Trades Review*, the fuel in question being coke-oven gas. He pointed out that by-product ovens are of two general types, waste-heat and regenerative. In the former the gas, after the by-products have been extracted, is conducted to combustion chambers between the oven retorts and mixed with air of atmospheric or slightly higher temperature, the products of combustion escaping to the chimney through a waste-heat flue, the internal appearance of which serves as a guide to the working of the ovens, as it indicates whether correct combustion is taking place. While with the waste-heat oven the hot gas passing to the chimney is first conducted through the flues of a boiler for steam raising, in the regenerative oven, the heat of the gas is retained or stored in chequer brickwork (in the regenerator), and the escaping gases are, or should be, at so low a temperature that no valuable heat is lost.

The regenerators are, of course, used to preheat the air before it enters the combustion chamber, being used alternatively to store heat from the gas and deliver this heat to the air, by means of flue dampers which give the required flue connections.

With the latter arrangement only 45 to 50 per cent. of the gas is required for oven heating, as against 85 to 100 per cent. with the waste-heat oven, and consequently a considerable amount of gas is available for other use. Some 80 per cent. or more of the coke-oven gas is used for steam raising.

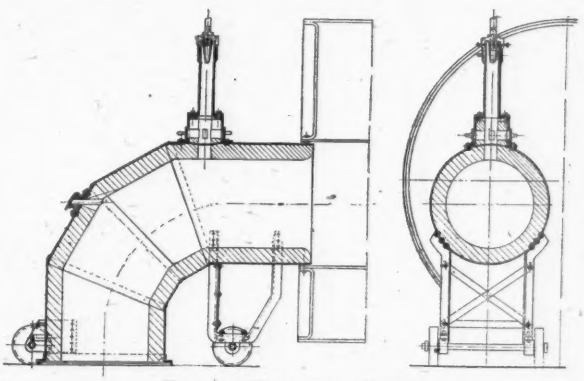


Fig. 1.—Waste-heat Bend.

At first glance the simpler and cheaper waste-heat oven would appear to be most suitable for this purpose, but owing to the necessity of avoiding heat losses from long flues, it is necessary to place the boilers close to the ovens, which may be disadvantageous in other ways. With the regenerative oven the cool gas, with by-products extracted, can be conducted any distance, and steam generated where it is required. Some steam is required on every coke-oven plant for its own use, and in practice a certain number of waste-heat and a proportionate number of regenerative ovens are installed, to meet both requirements; a method now often adopted with waste-heat ovens is to obtain all the steam possible on the site and convert it to electrical energy for distribution where required.

The waste-heat flue usually passes across the front of the boilers below ground, and flue connections are provided to the fronts of the boilers, being either fixed or movable. These connections are of steel plate lined with firebrick. A typical fixed connection is provided with a damper to cut off the waste-heat flue, and is of sufficient size to receive a grate so that solid fuel may be used in emergency, fire and ash doors being provided in the casing, also a hole for the introduction of live gas. This arrangement renders the boiler front inaccessible, and presents a large surface for heat radiation.

A more compact arrangement is the movable waste-heat bend shown in fig. 1, designed by the Koppers Co., which is mounted on wheels and can be entirely withdrawn. As in most waste-heat ovens 10 to 15 per cent. of live gas is to spare, this is introduced through a Bunsen burner mounted vertically on the bend. When in position the joints are luted up with fireclay. The use of live gas for boiler heating presents a more difficult problem in maintaining high efficiency and at the same time avoiding explosion.

The light and heat of a burning gas flame depend upon the conditions under which combustion takes place. There are but few cases nowadays of heating boilers with a lighting gas

flame, *i.e.*, igniting the gas escaping from the burner without previously adding air to it, but old works still retain examples.

An improvement upon the old arrangement is shown in fig. 2, where the gas is introduced through a series of 2-in. pipes direct into the furnaces; the gas pipes *a* are held in air channels *b*, and cover *d* regulates air admission. A fire is maintained on the grates to keep the gas ignited if its supply is not absolutely constant.

The modern method of burning gas is on the Bunsen system, giving a non-lighting flame; the principle is well known, but the original Bunsen arrangement has been further developed, and the Méker burner is an improved form in which the efficiency of the burner as an injector is largely increased, so that it draws through more numerous and enlarged air holes a greater amount of air as compared with the ordinary type, and yields greater heat. The Méker

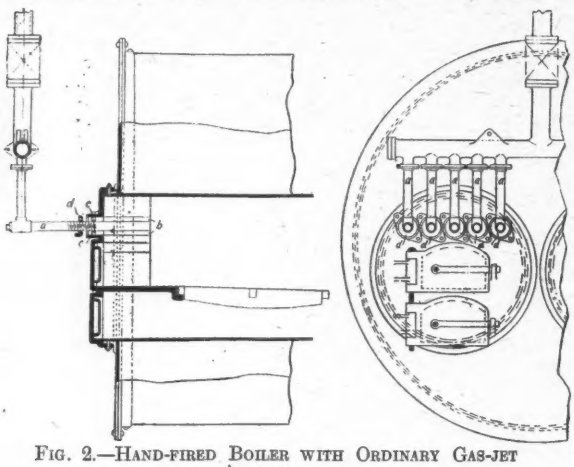


Fig. 2.—Hand-fired Boiler with Ordinary Gas-jet Attachment.

burner gives a homogeneous mass of flame at practically the same temperature throughout, and at a higher temperature than the hottest portion of the ordinary Bunsen flame.

The most common form of Bunsen burner for boilers is shown in fig. 3, where *c* is the gas nozzle, passing through a bell-shaped end *d*, with adjustable primary air slots *e*; *f* is the mixing tube, which where it joins the furnace front is provided with additional slots, for a secondary air supply at the point of ignition. This burner is in use on a number of water-tube boilers, but it has in common with the ordinary Bunsen burner the disadvantage that the mixing tube is rather small in diameter, and offers great frictional resistance to the gas, so that its action as an air injector is somewhat checked, and by not drawing in sufficient air for combustion its efficiency is comparatively low and its gas consumption high.

The type shown is unsuitable for a Cornish or Lancashire boiler if hand firing has to be provided for, as the horizontal burners interfere with stoking, and where provision for hand firing is essential vertical Bunsen burners as shown in fig. 4 are used.

This mainly differs from the previous form in the air

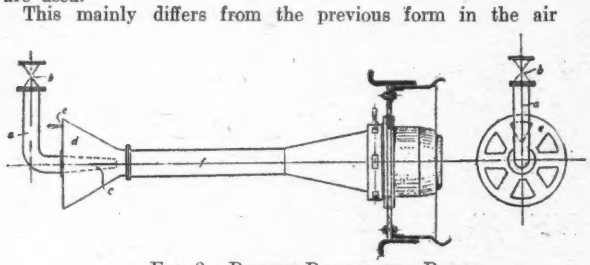


Fig. 3.—Bunsen Burner for Boiler.

chamber *a*; the end of the gas nozzle *c* just passes the air holes *d*, which can be adjusted by a loose ring *e*. The mixing tube *f* connects the air chamber to a bend *g* which reaches the furnace above the fire doors. A horizontal internal air inlet pipe *h* provides the secondary air for ignition; a slide *i* at the end of the inlet pipe allows of adjustment and the inspection of combustion in the furnace. A somewhat similar burner is shown on the bend in fig. 1; such a burner in an inverted position is very apt to back-fire, and great efficiency cannot be expected. In connection with waste-heat bends, however, it is so placed to avoid protruding too far.

With the general preference given to the regenerative oven it was a natural result to endeavour to construct gas burners with a much higher efficiency than could hitherto be attained. Among the many attempts which have been made in this direction are the Altenhein, the Terbeck, and the Wefer burners, so-called after their respective inventors.

The Altenhein burner (fig. 5), made by Messrs. Altenhein and Wilson, of Maryport, is of recent construction, and resembles in many ways the Méker burner. The mixing pipe *a* of the burner is tapered and reduced in diameter towards its delivery end in order to reduce the tendency to back-fire. The gas is supplied by means of an angular piece *b*, and the primary air is supplied partly by tube *c*, and partly by means of a series of inlet ports formed around the end of the mixing tube, and further by a series of slots arranged on the outer side of the burner practically in line with the end of the gas-inlet pipe *b*. Near the delivery end of the

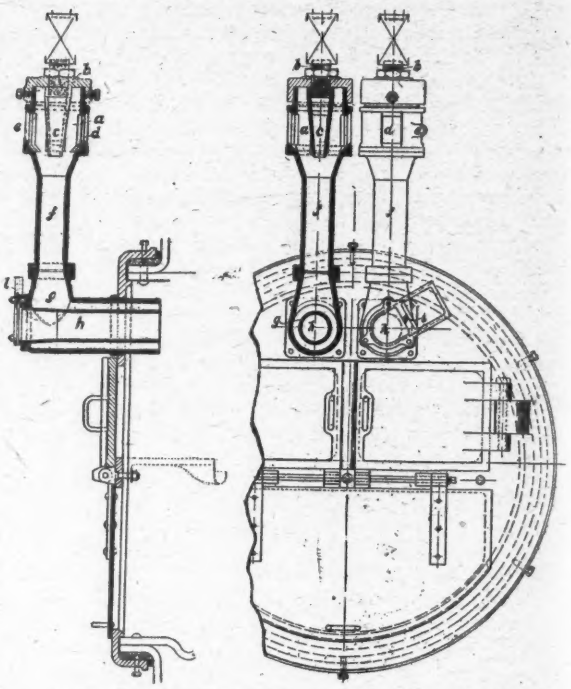


Fig. 4.—Bunsen Burners on Hand-fired Boiler.

burner the admission of the secondary air is provided for by a series of slots with a movable ring with corresponding openings. Fig. 5 represents the type of burner suitable for Lancashire and Cornish boilers; fig. 6 shows the construction as adopted for use in connection with water-tube boilers.

This form of construction gives the advantage that the mixing tube does not offer much frictional resistance owing to its comparatively large diameter. Consequently the injector effect of the burner is a good one, and back-firing does not take place even with an excessive amount of primary air added. The makers claim that an efficiency of 80 per cent. can easily be obtained. Fig. 7 shows an installation of these burners.

In the Terbeck burner the Bunsen system of forcing in gas through a nozzle and drawing in air is reversed; a great

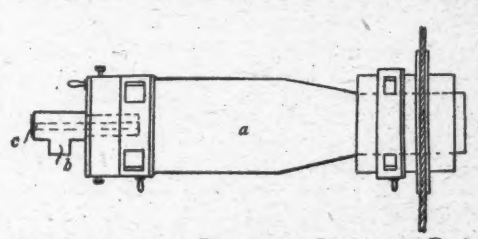


Fig. 5.—Altenhein Burner for Lancashire Boiler.

number of these burners are working satisfactorily on the Continent, and some are in use at the Old Silkstone Colliery.

The Wefer burner, fig. 8, is designed to prevent an accumulation of explosive gas in the mixing tube, which with Bunsen burners, if they have not been lit up carefully, may cause serious explosions or tendency to back-fire. In the Wefer burner the gas enters a distributing chamber *a* which on its front end is closed by an inclined door *b*, hinged from the top. The door acts as a safety valve, as in case of back-firing or explosion the pressure is relieved by the door opening and no harm done. To keep a gas-tight joint, a lead strip is fastened to the frame of the chamber against which the inner face of the lid is pressed by its own weight. In the distributing chamber are a number (generally 25) of pipes *c*, through which the gas travels to the boiler. The front plate of the boiler holds a carbon block *d*, which has a hole for every gas tube *c*, provided in such a way that the tubes are completely surrounded by an air space. The tubes *c* only reach three-quarters of the way into the carbon body *d*,

the last quarter being used to form small mixing chambers for air and gas. The space between the gas chamber *a*, and the carbon body *d*, is taken up by an air chamber *e*. This is provided with a circular row of slots *f*, surrounded by a loose ring by which the air supply to the burner is regulated. Above the burner two inspection holes *g* are arranged, below is a hinged door *h* for the removal of flue dust. While the gas travels through the pipes *c*, the air coming from the air chamber meets it at the outlet of the tubes in the last quarter of the carbon channels. On the end of the latter the mixture is ignited. As the velocity of the gas in this burner is naturally slow, the gas flame burns immediately on the end of the carbon block, which gets hot at the end. The carbon is not a good heat conductor, so that the rest

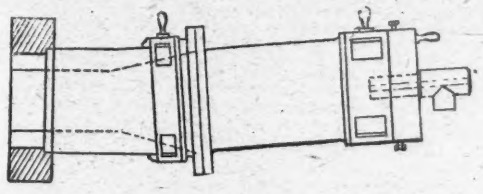


Fig. 6.—Altenhein Burner for Water-tube Boiler.

of the carbon block remains comparatively cool. The carbon is also so fire-resisting that it does not burn away easily. On the other hand, should the gas supply not be quite constant and short interruptions take place, the heat of the burner mouth is sufficient to reignite the gas and thus avoid explosions.

There is always a certain amount of danger connected with boilers solely heated by gas. The greatest danger is an intermittent gas supply due to variations in pressure or water accumulations in the supply pipes. In case of frequent variations of pressure, a governor should be provided in the gas-supply pipe to the boilers. With too high a pressure on a Bunsen burner, the air supply of which is suitable for a normal velocity of the gas, it easily happens that not sufficient air for combustion is injected, and the gas flare is suddenly extinguished through lack of air. If this happens to a whole series of burners at the same time it is not so serious. One has only to turn off the gas, wait a while until the gas mixture is drawn away by the chimney, and then the burners can be lighted again. But if only one part of the burners are extinguished and others kept burning, or if hand-fired boilers are in the same range, the combustible mixture from the extinguished burners may be ignited in the back flues and cause a serious explosion.

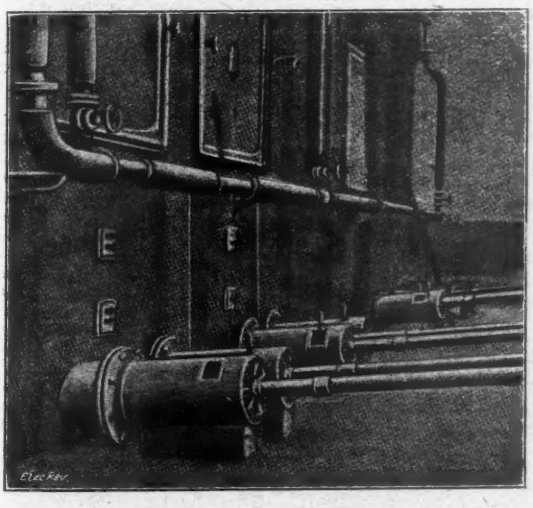


Fig. 7.—Installation of Altenhein Burners.

Great attention must be paid to the regulating of the air, especially the primary air supply, as with too little air part of the gas leaves the boiler unburnt, and besides the waste of gas through this cause, explosions in the flues at the back of the boilers may result. With too much primary air most Bunsen burners are apt to back-fire, so that the gas burns in the mixing tube.

In case of the gas having accidentally been extinguished in the boiler flue, in some boilers a little gas flare is kept burning, receiving its gas from an independent gas supply which acts like the small by-pass flame in a street lamp and relights the gas. If the gas goes out for want of air for combustion, this flame will also go out, and for such cases the arrangement cannot be called reliable. Undoubtedly the safest way is to keep a small fire burning under the burner, if possible.

The combustion of live gas in waste-heat boilers as shown in fig. 1 is safe, as the live gas is always kept ignited.

Experience has shown that the Bunsen flame has a cutting effect on tubes, and these are generally protected by a brick baffle, which gets very hot and will relight the gas flames if not too long extinguished. The indirect heating of boilers

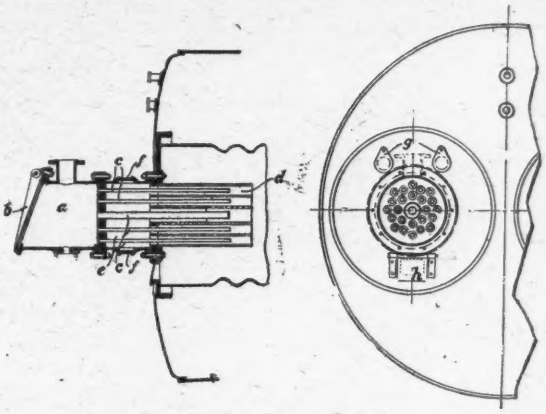


Fig. 8.—The Wefer Burner.

has led to the introduction of the Bonecourt surface combustion boiler, which has been described in our columns, but which, owing to its short body and tubes, is not available for alternative hand firing, and for this reason is not used on coke-oven plants.

While, no doubt, much may be learned from present practice in gas firing of boilers in coke-oven and similar installations, it is probable that the adoption of this system of

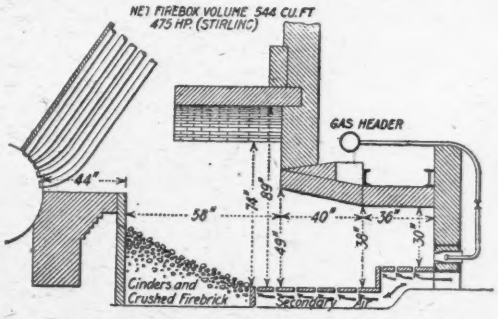


Fig. 9.—Dutch-oven Grate for Gas-firing.

generating steam for electrical purposes will result in a good deal of experimental work to meet the peculiar conditions of central-station practice. An instance of the kind was recently recorded in our American contemporary *Power*, which discussed the steps taken by the Toledo Railway and Light Co. in adopting coke-oven gas as fuel at its Water Street station. Due to lack of boiler capacity it was decided

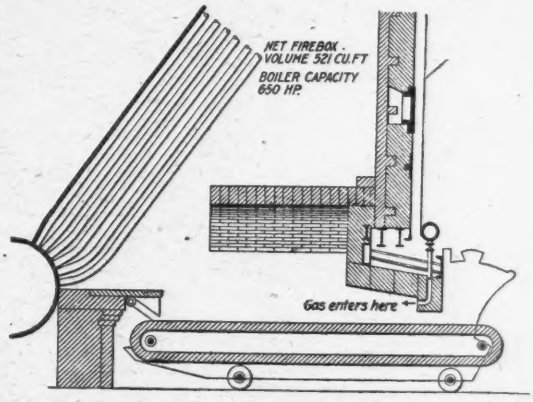


Fig. 10.—Combined Gas and Coal-firing on Chain Grate.

to develop a scheme for burning the gas which would give flexibility in operation, maximum capacity, and efficiency.

The gas was to be burned under six Stirling boilers with Green chain grates. The first arrangement, which did not give the high capacity and flexibility desired, consisted in covering the grate with sheet asbestos, except for a space

left as a secondary air port; crushed brick, egg size, was spread over the asbestos varying from 2½ in. at the front to 7 in. at the back of the grate (at the bridge wall) in depth. This deflected the flame so as not to strike the tubes directly.

The burners consisted of a 6-in. air mixer, 14 in. long, swaged down to 5 in. at the outlet. Gas was delivered to the burner through a 1½-in. pipe capped at the end and projecting into the air mixer about 4 in. In the face of the cap seven ⅜-in. holes were drilled, one in the centre and six equally distant round it. This arrangement being found unsatisfactory, the grates were removed in one boiler and the Dutch-oven arrangement shown in fig. 9 was adopted. It was then easy to get 1,250 H.P., or 263 per cent. rating, and the boiler has been operated continuously at 210 per cent. rating ever since; the arrangement, however, was absolutely inflexible, and was not extended.

The most satisfactory plan offering was to burn the gas directly above the coal and in combination with it. A special tile with a 5-in. hole was developed, and set so that the gas when introduced into the fire-box was directed down against the coal. This tile was placed in the ignition arch next the grate; the gas was introduced through a 1½-in. pipe and cap drilled as previously described. All primary air was shut off and the gas introduced into the furnace, useing the secondary air coming through the fuel bed for combustion. The boiler used for this experiment was a 425-H.P. Heine boiler equipped with Green grates. It was on the low-pressure end of the plant and could be spared. No attempt was made to determine ratings, but the gas was accurately metered and the flue gases were analysed.

Depth of fuel bed, in.	4⅞	4⅞	4⅞
With of chain grate, ft.	10	10	10
Chain speed, ft. per hour ...	16	22.5	25
Grate surface per hour, sq. ft.,	160	225	250
B.TH.U. in gas	600	600	600
Gas used per hour, cu. ft. ...	38,400	32,300	25,500

When the gas was fired above the coal the entire firebox was completely filled with flame so intense that it was impossible to see through it even with the aid of a blue glass. As the gas runs high in hydrogen its combustion is rapid, so that it is an ideal fuel for combination burning. Another successful feature of this combination is the fact that there is practically no combustible in the ash, even when the chains are running at maximum speed.

On the strength of the results obtained from this boiler, equipment has been ordered and is now being installed in the 16 Stirling boilers comprising the high-pressure end of the boiler room. Fig. 10 shows the new arrangement adapted to a Stirling boiler. It is considered this design will give absolute flexibility of boiler operation, added capacity by burning the gas in addition to the coal, and higher economy because no combustible reaches the ashpit.

Upon the completion of this work, evaporation tests will be run and the more complete data will be published later.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

14,312. "Plug for telephone switchboards, &c." P. P. Craven. October 9th

14,325. "Protecting devices for multiphase alternating-current apparatus." J. R. Beard & Messrs. Electrical Improvements, Ltd. October 9th.

14,345. "Electric machines." H. Chitty. October 9th.

14,348. "Processes for electro-deposition of lead." S. O. Cowper-Coles. October 9th.

14,351. "Coating metallic sheets, &c., with lead." S. O. Cowper-Coles. October 9th.

14,355. "Sound-operated circuit controller." Submarine Wireless Co. October 9th. (U.S.A., May 19th.)

14,371. "Preparation of material applicable for varnish, insulating, &c." W. T. Robinson-Bindley & A. W. Weller. October 10th.

14,383. "Device for collection of electric currents from revolving apparatus." B. A. M. Boyce & The Brush Electrical Engineering Co. October 10th.

14,416. "Electric condensers.' G. Giles. October 10th. (Switzerland, October 13th, 1915.)

14,417. "Electric motors." C. W. Durnford & The Submersible and J. L. Motors, Ltd. October 10th.

14,422. "Combined pumps and electric motors." C. W. Durnford and The Submersible & J. L. Motors, Ltd. October 10th.

14,423. "Electric motors." C. W. Durnford and The Submersible & J. L. Motors, Ltd. October 10th.

14,439. "Electrodes for storage batteries." R. Saville. October 11th.

14,466. "Electric furnaces." J. W. Moffat. October 11th.

14,467. "Electrolytic deposition of copper from acid solutions." F. E. Studt. October 11th.

14,509. "Electrical connections." A. F. Berry, The British Electric Transformer Co. & E. Ellwood. October 12th.

14,518. "Electric ship propulsion." The British Thomson-Houston Co. (General Electric Co.). October 12th.

14,521. "Electric commutators." Sykes Interlocking Signal Co. & R. W. Tarrant. October 12th.

14,522. "Electric commutators." Sykes Interlocking Signal Co. & R. W. Tarrant. October 12th.

14,524. "Apparatus for electrically sterilising foods." J. Hanssen. October 12th. (Norway, October 12th, 1915.)

14,546. "Duplex circuits." Western Electric Co. October 12th. (U.S.A., October 13th, 1915.)

14,566. "Magnetic controlling devices." C. Marshall. October 13th.

14,593. "Sparking plugs." W. C. Matthews. October 13th.

14,629. "Electro-magnetic separator." A. F. Hallimond. October 14th.

14,631. "Electrical treatment of organic and inorganic substances." G. Caraccio. October 14th.

14,643. "Electric incandescent lamps filled with argon." Allgemeine Elektricitats Ges. October 14th. (Germany, November 11th, 1915.)

PUBLISHED SPECIFICATIONS.

1915.

9,344. Means for Producing and Deflecting a Jet of Liquid and for Magnifying and Utilising such Deflection. A. F. Sykes & S. Ford. June 25th. (Cognate applications, 11,885/15, 635/16, and 1,001/16.)

12,193. Insulators for Electrical Resistances and Conductors. A. E. Woodhouse. August 24th.

12,404. Telephone Systems. E. V. Datzevitch. August 28th.

13,614. Electric Selective Devices. A. H. Morse & Indo-European Telegraph Co., Ltd. September 24th.

13,801. Regulation of Dynamo-electric Machines in Continuous-current Supply Systems for "Series" Operation. R. Thury. September 28th (Convention date, June 16th, 1915, Switzerland.)

13,902. Thermic Telephones. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. September 30th. (Convention date, April 26th, 1915, Germany.)

14,043. Electric Bath Blanket. H. D. Parker. October 4th.

15,471. Apparatus for Adjustably Holding X-ray Tubes. E. H. Hanson and Harry W. Cox & Co. November 2nd.

16,694. Electric Arc Lamps. A. H. Railing & A. E. Angold. November 26th.

17,185. Thermo-electric Couple. C. E. Foster. December 7th.

17,330. Sparking Plugs for Internal-combustion Engines. S. A. Newman (H. C. Newman, British Expeditionary Force). December 9th.

1916.

The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1,724. Electrical Resistances. Clarke, Chapman & Co. and R. C. Harris. February 4th, 1916. [101,498.]

3,817. Explosion Engines coupled to Dynamo-electric Machines. Soc. Anon. des Etablissements L. Bleriot. April 10th, 1915. (Addition to 11,566/15.) [100,268.]

7,100. Telephone Systems. Automatic Telephone Manufacturing Co. July 19th, 1915. [100,941.]

8,754. Means for Controlling and Regulating Electric Motors. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). January 28th. (Divided application on 1,374/16.) [101,523.]

Electrolytic Treatment of Zinc Ores.—The *Queensland Government Mining Journal* (Brisbane) of August 15th reports in the local Press an announcement to the effect that works are to be erected at Bowen, Queensland, for the electrolytic treatment of zinc ores. It is understood that the company concerned has for some time past been considering the advisability of putting up such works at either Townsville or Bowen. Evidently the decision has turned in favour of Bowen, and an application has been made to the Lands Department for the lease of an area of land at that place suitable for the proposed works.

The Operation of Electric Excavators.—Some unusual and interesting schemes have been developed in connection with the utilisation of energy for operating excavators in the Little River Drainage District near Cape Girardeau, Mo. The excavators are being used to construct a 30-mile diversion channel and levees along the system. When the project was first started each excavator was supplied with energy from two 100-KW. transformers, carried on wide-tired trucks alongside a transmission line paralleling the channel route. Wet and muddy paths that hindered moving the trucks were encountered so frequently, however, that it was decided to transport the transformers on small barges built on the job. The high-tension lines leading to the barge are held above the ground and at the proper distance apart by insulators attached to the top of posts. The vertical jumpers connecting these lines with the transformers are supported at intermediate points by insulators attached to a short cross-arm and to the barge railing. To permit moving the transformer barge without adjusting the branch line tap each time, it is connected with the line by an ingenious roller-contact device, consisting of two ordinary sash pulleys attached to a piece of sheet steel bent to form a rider similar to a barn-door hanger. From the rider is suspended an insulator attached to a rope which is employed to move the rider along the line when the barge is moved. When the end of a span is reached the transmission line is de-energised long enough to permit setting the rider on the adjacent span in the direction of excavation.

Energy at the voltage required for operating the excavator motors is conducted from the transformers to the machines through flexible insulated cables. Since these are allowed to lie on the earth between the barge and the excavator, they have to be dragged on the ground when the excavator is moved. To facilitate performing this operation without receiving shocks through insulation which may be worn thin, shovel handles are provided with hooks bolted to the end. On one of the dredges electric fans have been used with satisfactory effects in the daytime to keep mosquitos from annoying the operators. At night, however, the damp draughts produced by the fans are almost as unbearable as the mosquitos.—*Electrical World.*